

SECTION 15140--PIPING SUPPORT SYSTEMS

PART 1--GENERAL

REFERENCES:

The following is a list of standards which may be referenced in this section:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A525 Standard Specification for General Requirements for Steel Sheet,
Zinc-Coated (Galvanized) by the Hot-Dip Process

BUILDING OFFICIALS AND CODE ADMINISTRATORS (BOCA)

Basic Building Code

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

Uniform Building Code

MANUFACTURERS' STANDARDIZATION SOCIETY (MSS)

SP 58 Pipe Hangers and Supports-Materials, Design and Manufacture
SP 69 Pipe Hangers and Supports-Selection and Application
SP 89 Pipe Hangers and Supports-Fabrication and Installation

DEFINITIONS:

Ferrous Metal: Iron, steel, stainless steel, and alloys with iron as principal component.

Wetted or Submerged: Submerged, less than 1 foot above liquid surface, below top of channel wall, under cover or slab of channel or tank, or in other damp locations.

DESIGN REQUIREMENTS:

General:

Piping Smaller than 30 Inches: Supports are shown only where specific types and locations are required; additional pipe supports may be required.

Meet requirements of MSS SP 58, MSS SP 69, and MSS SP 89.

Pipe Support Systems:

Support Load: Dead loads imposed by weight of pipes filled with water, except air and gas pipes, plus insulation.

Safety Factor: Minimum of 5.

Maximum Support Spacing and Minimum Rod Size:

Steel or Ductile Iron Piping:

<u>Pipe Size</u>	<u>Maximum Support/ Hanger Spacing</u>	<u>Minimum Rod Size Single Rod Hangers</u>
1-inch and smaller	6 feet	1/4-inch
1-1/2-inch thru 2-1/2-inch	8 feet	1/4-inch
3-inch and 4-inch	10 feet	3/8-inch

Plastic and Fiberglass Piping:

Maximum Support Spacing: As recommended by manufacturer for flow temperature in pipe. Pipe insulation shall be included in the selection of maximum pipe support spacing.

Minimum Hanger Rod Sizing: Same as listed for steel pipe.

Framing Support System:

Beams: Size such that beam stress does not exceed 25,000 psi and maximum deflection does not exceed 1/240 of span.

Column Members: Size in accordance with manufacturer's recommended method.

Support Loads: Calculate using weight of pipes filled with water.

Maximum Spans:

Steel and Ductile Iron Pipe, 3-Inch Diameter and Larger: 10-foot centers, unless otherwise shown.

Other Pipelines and Special Situations: May require supplementary hangers and supports.

Electrical Conduit Support: Include in design of framing support system.

Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear and pullout loads imposed by loading and spacing on each particular support.

Vertical Sway Bracing: 10-foot maximum centers, or as shown.

PART 2--PRODUCTS

GENERAL:

When specified items are not available, fabricate pipe supports of correct material and to general configuration indicated by catalogs.

Special support and hanger details are shown for cases where standard catalog supports are inapplicable.

Materials:

Wetted and Submerged: Stainless steel.

Atmospheric Exposed: Galvanized or painted steel.

HANGERS:

Clevis Type: MSS SP 58, Type 1 or 6.

Grinnell; Figure 104 or 260.

B-Line; Figure B3198 or B3100.

Hinged Split-Ring Pipe Clamp: MSS SP 58, Type 6 or 12.

Grinnell; Figure 104.

B-Line; Figure B3198H.

Hanger Rods, Clevises, Nuts, Sockets, and Turnbuckles: In accordance with MSS SP 58.

Attachments:

I-Beam Clamp: Concentric loading type, MSS SP 58, Type 21, 28, 29, or 30, which engage both sides of flange.

Concrete Insert: MSS SP 58, Type 18, continuous channel insert with load rating not less than that of hanger rod it supports.

1
2 SADDLE SUPPORTS:

3
4 Pedestal Type: Schedule 40 pipe stanchion, saddle, and anchoring flange.

5
6 Nonadjustable Saddle: MSS SP 58, Type 37 with U-bolt.

7
8 Grinnell; Figure 259.

9
10 B-Line; Figure B3090.

11
12 Adjustable Saddle: MSS SP 58, Type 38 without clamp.

13
14 Grinnell; Figure 264.

15
16 B-Line; Figure B3093.

17
18 WALL BRACKETS:

19
20 Welded Steel Bracket: MSS SP 58, Type 33 (heavy-duty).

21
22 Grinnell; Figure 199.

23
24 B-Line; Figure B3607.

25
26 One-Hole Clamp: Grinnell; Figure 126.

27
28 Channel Type:

29
30 Unistrut.

31
32 Kin-Line.

33
34 PIPE CLAMPS:

35
36 Riser Clamp: MSS SP 58, Type 8.

37
38 Grinnell; Figure 261.

39
40 B-Line; Figure B3373.

1 CHANNEL TYPE SUPPORT SYSTEMS:

2
3 Material:

4
5 Galvanized: Pre-galvanized in accordance with ASTM A525, Class G90, or hot-dip
6 galvanized after fabrication.

7
8 Stainless Steel: Type 304 stainless steel.

9
10 Channel Size: 12-gauge, 1-5/8-inch wide series minimum.

11
12 Members and Connections: Design for all loads with safety factor of 5.

13
14 Manufacturers and Products:

15
16 Kin-Line; Series CI3812.

17
18 Unistrut; Series P3200.

19
20 ANCHORING SYSTEMS:

21
22 Material:

23
24 Wetted and Submerged: Stainless steel.

25
26 Atmospheric Exposed: Galvanized.

27
28 Size: Sized by equipment manufacturer, 1/2-inch minimum diameter.

29
30 SHOP/FACTORY FINISHING:

31
32 Prepare, prime, and finish coat in accordance with:

33
34 Surface preparation with abrasive blast or centrifugal wheel blast (SP10).

35
36 Paint with:

37
38 One coat, 2.5 minimum dry film thickness (MDFT) of Epolon rust inhibitor
39 primer.

40
41 One coat, 2.5 MDFT Epolon Multi-Mill Epoxy.

42
43 One coat, 1.5 MDFT Acrolon II, No. 2200 Series.

1 PART 3--EXECUTION

2
3 INSTALLATION:

4
5 General:

6
7 Install support systems in accordance with MSS SP 69, Pipe Hangers and Supports-Selection
8 and Application and MSS SP 89, Pipe Hangers and Supports-Fabrication and Installation,
9 unless shown otherwise.

10
11 Support piping connections to equipment by pipe support and not by the equipment.

12
13 Support large or heavy valves, fittings, and appurtenances independently of connected
14 piping.

15
16 Support no pipe from the pipe above it.

17
18 Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings,
19 and where shown.

20
21 Do not install pipe supports and hangers in equipment access areas or bridge crane runs.

22
23 Brace hanging pipes against horizontal movement by both longitudinal and lateral sway
24 bracing.

25
26 Install lateral supports for seismic loads at all changes in direction.

27
28 Repair mounting surfaces to original condition after attachments are made.

29
30 Standard Pipe Supports:

31
32 Horizontal Suspended Piping:

33
34 Single Pipes: Adjustable swivel-ring, splint-ring, or clevis hangers.

35
36 Grouped Pipes: Trapeze hanger systems.

37
38 Furnish galvanized steel protection shield and oversized hangers for all
39 insulated pipe.

40
41 Furnish precut sections of rigid insulation with vapor barrier at hangers for all
42 insulated pipe.
43

1 Horizontal Piping Supported From Walls:

2
3 Single Pipes: Wall brackets or wall clips attached to wall with anchors. Clips
4 attached to wall mounted framing also acceptable.

5
6 Stacked Piping:

7
8 Wall-mounted framing system and clips acceptable for piping smaller
9 than 3-inch minimal diameter.

10
11 Piping clamps which resist axial movement of pipe through support
12 not acceptable.

13
14 Wall-mounted piping clips not acceptable for insulated piping.

15
16 Horizontal Piping Supported From Floors:

17
18 Stanchion Type:

19
20 Pedestal type; adjustable with stanchion, saddle, and anchoring flange.

21
22 Use yoked saddles for piping whose centerline elevation is 18 inches
23 or greater above the floor and for all exterior installations.

24
25 Floor Mounted Channel Supports:

26
27 Use for piping smaller than 3-inch nominal diameter running along
28 floors and in trenches at piping elevations lower than can be
29 accommodated using pedestal pipe supports.

30
31 Attach channel framing to floors with anchor bolts.

32
33 Attach pipe to channel with clips or pipe clamps.

34
35 Vertical Pipe: Support with wall brackets and base elbow or riser clamps on floor
36 penetrations.

37
38 Standard Attachments:

39
40 To Steel Beams: I-beam clamp or welded attachments.

41
42 To Concrete Walls: Concrete inserts or brackets or clip angles with anchor
43 bolts.

Project Title: ICDF Landfill and Evaporation Pond RD/CWP – Title II
Document Type: Technical Specifications
SPC Number: 1476
Revision Number: 2

1 FIELD FINISHING:

2

3 Paint atmospheric exposed surfaces of black and hot-dip galvanized steel components as
4 specified in Article SHOP/FACTORY FINISHING.

5

6 END OF SECTION

SECTION 15505--UNDERGROUND FIRE PROTECTION PIPING

PART 1--GENERAL

SUMMARY:

Work includes, but is not limited to:

Layout, fabricate, install, flush, and test a complete underground supply system including pipe, fittings, thrust blocks, rodded connections and all necessary accessories and components to assure a complete and operable system. Subcontractor shall be responsible for coordinating all existing and new work.

RELATED SECTIONS:

02316 Excavation
03301 Concrete
02320 Trench Backfill

REFERENCES:

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

UBC - 1997 Uniform Building Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 - 1999 Standard for the Installation Sprinkler Systems
NFPA 14 - 1999 Standard for the Installation of Standpipe, Private Hydrant, and
Hose Systems
NFPA 24 - 1999 Standard for the Installation of Private Fire Service Mains and
their Appurtenances

FACTORY MUTUAL (FM)

FM Approval Guide Fire Protection
FM Data Sheet 3-10 Installation and Maintenance of Private Fire Service Mains and
Their Appurtenances

UNDERWRITERS LABORATORIES INC. (UL)

UL Directory - 2001 Fire Protection Equipment
UL 194 Pipe and Fittings
UL 1285 PVC Pipe and Couplings for Underground Fire Service

NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE)

RPO 169 Control of External Corrosion on Underground or Submerged Metallic
Piping Systems – Item No. 21001

SYSTEM DESCRIPTION:

Project Drawings: The project drawings do not attempt to show complete details of the site utilities, which affect the fire protection installation. The drawings in part are diagrammatic and do not show all offsets, fittings, valves, equipment, etc. It is absolutely essential to study the architectural, structural, mechanical, and electrical drawings and confer with the various trades involved, to the end that there is no conflict between the fire protection system and the work of other trades and to assure that the owner secures the best arrangement of work consistent with the use of space.

Layout Criteria: The underground fire protection piping shall be laid out and installed in accordance with the referenced codes and standards.

Thrust Blocks: Thrust blocks shall be used to restrain fire mains. Thrust blocks shall be sized by a NICET Level IV certified person. The soil shall be considered to have a maximum 3000-psf horizontal bearing strength. A minimum safety factor of 2 shall be used in thrust block calculations.

Piping: Depth of bury shall be as outlined in the referenced codes. However, in no case shall it be less than 6 ft. to the top of pipe. Any depth of bury less than 6 ft. will require pre-authorization by the Contractor. The fire water pipeline shall be sized as shown on drawing sheet FP-3.

Fire Hydrants: Fire hydrants and valves are to be installed to proper finished grade. Hydrants shall be set so that the 2½-inch outlets are 20 inches (plus or minus 2 inches) above finished grade level and to have the pumper connection pointing toward the road way for Fire Department access. Protective devices placed around the hydrant shall be located in a manner that will not interfere with connecting hoses too or flowing water from the hydrant ports.

The key valve for the hydrant shall be located such that connection of fire hose to the 4½-inch pumper connection will not hinder the operation of the valve.

Valving: Sectional and control valves installed on the underground fire main shall be equipped with electrical supervision. Electrical duct banks and/or conduit leading to the supervision device shall not be placed directly over the underground fire main.

Pipe Identification: Identification tape shall be spiral wrapped around the underground fire main.

The tee connecting the new piping to the existing system shall be protected by a sacrificial galvanic anode installed in accordance with NACE Standard RPO-169.

SUBMITTALS:

Vendor data requirements for this section are summarized on the Vendor Data Schedule.

Layout: The fire water supply system layout shall be submitted as a complete package for review. Complete packages shall include thrust block calculations, thrust block details, and piping method including make and model of all equipment used. Partial submittals will be considered as incomplete and will not be reviewed. The layout must receive an “A” or “B” designation by the Contractor prior to beginning of installation and shall comply with NFPA 13, 14, 24 FM 3-10, and FM Approval Guide requirements.

The Subcontractor shall submit all layout drawings for approval prior to construction. All drawings shall be completed on size D (22" X 34") CAD generated drawings. Lettering size shall be a minimum of 1/8 (.125)" inch for all lettering on the main body of the drawing. Border and title block shall follow format in this drawing package. Drawings shall be done using AutoCAD or a similar program, which generates drawing files, which are compatible with AutoCAD 2000 and use a simplex font. An electronic copy of the As-Built configuration shall be furnished in addition to the original drawing plots.

An electronic copy of border and title block format, as well as the associated drawings are available upon request. An A/E Drawing Standard format is available upon request.

Thrust block calculation shall be submitted for information. These calculations shall show the formula used, overall size, and the individual side dimensions for the thrust blocks used in this installation. A detail shall be provided on the layout drawings that correlates to the dimensions provided by the calculations.

QUALITY CONTROL SUBMITTALS:

Procedures: The Subcontractor shall submit a hydrostatic test procedure and a detailed, job specific flushing procedure. The flushing procedure shall outline where the flushing water will be obtained and how it will be disposed of in a safe manner. It shall also outline how the flow will be monitored to assure adequate flow and how long the flow must be maintained to adequately flush the piping. This procedure must be submitted for review prior to any connections to existing plant piping.

Certifications: A Contractor’s Material and Test Certification for Under-Ground Piping shall be completed and accepted, for each major portion of the work covered by this specification prior to final acceptance of the installation.

See Section 01300, Submittals and the Vendor Data Schedule for additional submittal requirements.

QUALITY CONTROL:

Qualifications: The Subcontractor for the underground fire protection piping shall have a NICET Certified Engineering Technician (CET) in Fire Protection with a minimum Level IV rating. This person shall be required to certify that the drawings are in accordance with this specification and all the regulatory requirements. The CET shall sign all drawings.

Manufacturers: Firms regularly engaged in the manufacture of underground fire protection piping accessories of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

Installer: A firm with at least 3 years of successful installation experience on projects with fire sprinkler piping similar to that required for this project. The installing Subcontractor shall be licensed, by the State of Idaho, as a Fire Protection Sprinkler Contractor.

Materials: Provide piping, fittings, and devices with a UL listing and FM approval unless a specified product is only covered by one of the agencies. Exceptions will be made on a case-by-case basis for the products submitted as or equals. If no product exists that has both a UL listing and FM approval, it will be acceptable to use a product that has been published in either organization's publications.

Regulatory Requirements (Codes and Standards): Comply with the provisions of the following codes and standards unless otherwise specified herein.

NFPA 13
NFPA 14
NFPA 24
FM Data Sheet 3-10

DELIVERY, STORAGE AND HANDLING:

All materials shall be delivered to and stored at the job site in a manner, which will prevent foreign material from getting inside the piping and valves.

PART 2--PRODUCTS

MATERIALS AND EQUIPMENT:

PVC Pipe: Underground fire water piping shall be Class 200 PVC and shall be UL 1285 listed. Pipe shall be JM Pipe model Blue Brute Model Class 200, PW Pipe Model Twinseal

1 Class 200 DR14. The piping shall be rated for a working pressure of 175 psi, and shall have a
2 6-ft minimum depth of coverage to top of pipe.

3
4 Ductile Iron Fittings: Underground fittings shall be ductile iron mechanical or slip joint,
5 cement lined and be UL 198 listed. The fittings shall be rated for a working pressure of 175
6 psi, and shall have a 6-ft minimum depth of coverage to top of pipe. Fittings shall be U.S.
7 Pipe, Models Tyton Joint and/or Mechanical Joint. Plain end fittings should not be used.

8
9 Rodding: Studs or threaded rod shall conform ASTM A 307 Grade B and use nuts that
10 conform with ASTM A 563 Grade A, heavy hex. Washers shall be steel or ASTM A 126
11 class A cast iron, round or square as required. Rod couplings or turnbuckles shall be ASTM
12 A 197 malleable iron. Rodding shall be used where piping penetrates foundation or floor
13 slabs.

14
15 Post Indicating Valve (PIV): PIVs shall consist of a UL listed and FM approved, resilient
16 wedge gate valve and indicator post from the same manufacture. The valve shall be
17 mechanical joint or flanged. The PIV shall be a Clow Model F-6120, Waterous Series 500.

18
19 Fire Hydrants: Hydrants shall be dry barrel with a with a 5¼ in. minimum main valve
20 opening, rated for a working pressure of 175 psig, open counterclockwise and have two 2½
21 in. hose connections and one 4½-inch pumper connection. Hose connections shall be
22 National Standard fire hose threads.

23
24 Hydrants shall have drain holes and mechanical joint (MJ), flanged, or TYTON connections,
25 allow for servicing from above ground and be equipped with a traffic safety flange to allow
26 for a clean break when the hydrant is hit.

27
28 Hydrants shall be a Clow Medallion, Model No. F-2545, Waterous model WB-67UF.

29
30 Key Valve with Road Box: Key valves shall be resilient wedge gate valve, Clow Model
31 F-6106, Waterous Series 500. The valves shall have mechanical joint, flanged, or other
32 approved ends. Provide 4" cast ductile iron valve stand pipe, road box and key valve wrench.

33
34 Valve Tamper Switch: All valves controlling fire protection water supplies shall be provided
35 with electronic valve supervision capabilities. Switch shall have two sets of S.P.D.T.
36 contacts, use Potter Model PCVS.

37
38 Set Screw Retaining Gland: Provide set screw retaining gland and associated screws. Use
39 Megalug 1100 Series for ductile iron pipe or Series 2000PV for PVC pipe. This gland is to
40 be UL or FM approved.

41
42 Underground Pipe Identification: New underground pipelines shall be identified by use of a
43 plastic ribbon no less than 3 in. in width with a message printed on the ribbon, which

identifies the actual pipeline contents. The plastic ribbon shall be color coded in conformance with the following:

<u>Categories of Pipeline Contents</u>	<u>Tape</u>	<u>Lettering</u>
Fire Water	Red	White

PART 3--EXECUTION

INSTALLATION:

Materials: Only new and approved pipe, fittings, and devices shall be employed in the installation of the underground system.

Thrust Blocks: Forms shall be used in the placement of the thrust blocks. Thrust blocks shall be placed against undisturbed soil. If the thrust blocks cannot be placed against undisturbed soil it will be permissible to compact the soil behind the thrust block to a minimum of 90% proctor.

Thermite Weld Wire Connections: Electrical connection of copper wire to metallic surfaces shall be by the thermite weld method where it is safe to do so. In the event conditions at the negative connection site preclude thermite welding, an above ground connection may be made with a pipe clamp.

The area where the connection is to be made shall be cleaned to bare metal by making a 2" square window in the coating, and then filing or grinding the surface to produce a bright metal surface. Wire sleeves shall be used on wire size as recommended by the manufacturer. The proper mold for pipe size and wire shall be used as recommended by the manufacturer. The mold and base metal shall be clean and dry.

After the weld connection has cooled, remove slag, visually and physically test the quality of the connection by tapping with a hammer. The weld should present a well formed appearance with minimal loss of weld material.

Clean the completed thermite weld connection area with a wire brush. Prime and-install a prefabricated weld cap over each connection. Other welded underground wire to pipe connections shall be cleaned and coating repaired in the same manner.

Underground Pipe Identification: Ribbon shall be spiral wrapped around the pipeline at no less than 1 wrap per 3 ft. of run.

1 SPECIAL CONDITIONS:

2
3 See Special Conditions for pipe tie-in information.

4
5 FIELD QUALITY CONTROL:

6
7 One set of approved installation shop drawings shall be maintained on the project site during
8 construction. The Subcontractor shall redline all changes daily. The redline drawings shall
9 be incorporated on the "as-built" design drawings by the Subcontractor.

10
11 Acceptance Tests:

12
13 Flushing of Piping: New underground mains and lead-in connections to system risers
14 shall be flushed thoroughly immediately after tie-in to system is made or before
15 connection is made to the sprinkler piping.

16
17 Flush underground mains through hydrants at dead ends of the system or through
18 accessible aboveground flushing outlets allowing the water to run until clear and
19 move any foreign material out of the piping.

20
21 If water is supplied from more than one source or from a looped system, divisional
22 valves shall be closed to produce a high velocity flow through each single line.

23
24 A flow of 880 gpm (6 inch line), 1560 gpm (8" line), 2440 gpm (10 inch line), or
25 3520 gpm through a 12 inch line will produce a velocity of at least 10 ft/sec (3.0
26 m/sec), which is necessary, for cleaning the pipe and for lifting foreign material to an
27 above-ground flushing outlet.

28
29 Test of Piping System: All new underground Fire System piping shall be
30 hydrostatically tested at not less than 225 psi pressure for two hours.

- 31
32 1. Slowly fill with water each section of the main to be tested.
33 2. Expel all air by opening hydrants at the highpoints of the system and at both
34 ends, or by bleeding air through the sprinkler drains.
35 3. Open wide the valve controlling the admission of water before shutting the
36 hydrants or drains.
37 4. After the system has been filled with water and the entrapped air expelled,
38 close the valve controlling the section being tested and begin applying
39 pressure.
40 5. Increase the water pressure in 50-psi increments until the specified test
41 pressure is attained.
42 6. After each increase in pressure, make observations of the stability of the
43 joints. In these observations, include such items as protrusion or extrusion of

- 1 the gasket, leakage or other factors likely to affect the continued use of a pipe
- 2 in service.
- 3 7. During the test increase the pressure to the next increment only after the joint
- 4 has been determined to be stable. This applies particularly to movement of the
- 5 gasket.
- 6 8. After the pressure has been increased to the required maximum value and held
- 7 for two hours with no loss in pressure.
- 8 9. Decrease the pressure to 0 psi while observing for leakage. Then slowly
- 9 increase the pressure to the specified maximum and hold the pressure for one
- 10 more hour.

11
12 **Warning:** Do not use the fire pumps to supply pressure. A pipeline break
13 during testing could result in damage from the large flow of escaping water.
14 Instead, use a small hydrostatic test pump.

15
16 Test for Dry-Barrel Hydrants:

17
18 Each dry barrel hydrant shall be tested as follows:

- 19
- 20 1. Following the hydrostatic pressure test, close the hydrant main valve.
- 21 2. Remove one outlet-nozzle cap and place the palm of one hand over the outlet-
- 22 nozzle opening.
- 23 3. Drainage should be sufficiently rapid to create a noticeable suction.
- 24 4. If the hydrant fails the drainage test, partially open the hydrant with the outlet-
- 25 nozzle caps on to create a pressure that will clear the drain valve. If this fails,
- 26 then the drain valve assembly should be removed and inspected. If the drain
- 27 valve is clear, then the problem may be that the drain outlet is plugged from
- 28 outside the hydrant Repair will require digging down around the outside of the
- 29 hydrant and clearing the drain outlet.

30
31 The underground fire water main must be flushed and accepted per the Contractor's
32 Material and Test Certificate.

33
34 Testing and flushing shall be witnessed by the Contractor's Representative.

35
36 END OF SECTION 15505

Project Title: ICDF Landfill and Evaporation Pond RD/CWP – Title II
Document Type: Technical Specifications
SPC Number: 1476
Revision Number: 2

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

Appendix A

Contractors Material and Test Certificate for Underground Piping

1 **CONTRACTOR'S MATERIAL AND TEST CERTIFICATE FOR UNDERGROUND**
2 **PIPING**
3

PROCEDURE		
Upon completion of work, inspection, and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.		
A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.		
Property Name		Date
Property Address		
PLANS	Accepted by approving authorities (names)	
	Address	
	Installation conforms to accepted plans <input type="checkbox"/> YES <input type="checkbox"/> NO	
	Equipment used is approved <input type="checkbox"/> YES <input type="checkbox"/> NO If no, state deviations	
INSTRUCTIONS	Has person in charge of fire equipment been instructed as to location of control valves and care and maintenance of this new equipment? If no, explain <input type="checkbox"/> YES <input type="checkbox"/> NO	
	Have copies of appropriate instructions and care and maintenance charts been left on premises? If no, explain <input type="checkbox"/> YES <input type="checkbox"/> NO	
LOCATION	Supplies Buildings	
UNDERGROUND PIPES AND JOINTS	Pipe Types and Class	Type Joint
	Pipe conforms to _____ Standard <input type="checkbox"/> YES <input type="checkbox"/> NO	
	Fittings conform to _____ Standard <input type="checkbox"/> YES <input type="checkbox"/> NO If no, explain	
	Joints needing anchorage clamped, strapped, or blocked in accordance with _____ Standard <input type="checkbox"/> YES <input type="checkbox"/> NO If no, explain	

<p align="center">TEST DESCRIPTION</p>	<p><u>Flushing</u>: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at flows not less than 390 GPM (1476 L/min) for 4-inch pipe, 880 GPM (3331 L/min) for 6-inch pipe, 1560 (5905 L/min) for 8-inch pipe, 2440 GPM (9235 L/min) for 10-inch pipe, and 3520 GPM (13323 L/min) for 12-inch pipe. When supply cannot produce stipulated flow rates, obtain maximum available and concurrence of the INEEL Fire Marshall.</p> <p><u>Hydrostatic</u>: Hydrostatic tests shall be made at not less than 200 psi (13.8 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.3 bars) for two hours.</p> <p><u>Leakage</u>: New pipe laid with rubber gasketed joints shall, if the workmanship is satisfactory, have little or no leakage at the joints. The amount of leakage at the joints shall not exceed 2 qts. Per hr. (1.89 L/h) per 100 joints irrespective of pipe diameter. The leakage shall be distributed over all joints. If such leakage occurs at a few joints the installation shall be considered unsatisfactory and necessary repairs made. The amount of allowable leakage specified above may be increased by 1 fl oz per in. valve diameter per hr. (30 mL/25 mm/h) for each metal seated valve isolating the test section. If dry barrel hydrants are tested with the main valve open, so the hydrants are under pressure, an additional 5-oz per minute (150-mL/min) leakage is permitted for each hydrant.</p>						
<p align="center">FLUSHING TESTS</p>	<table border="1"> <tr> <td data-bbox="532 1125 1266 1344"> <p>New underground piping flushed according to approved flushing procedure dated _____ by _____ (company) If no, explain</p> </td><td data-bbox="1266 1125 1503 1344"> <p align="right"><input type="checkbox"/> YES <input type="checkbox"/> NO</p> </td></tr> <tr> <td data-bbox="532 1344 933 1533"> <p>How flushing flow was obtained <input type="checkbox"/> Public Water <input type="checkbox"/> Tank or Reservoir <input type="checkbox"/> Fire pump</p> </td><td data-bbox="933 1344 1503 1533"> <p>Through what type opening <input type="checkbox"/> Hydrant butt. <input type="checkbox"/> Open pipe Give C factors and pitot readings in comment section.</p> </td></tr> <tr> <td data-bbox="532 1533 1266 1747"> <p>Lead-ins flushed according to approved flushing procedure dated _____ by _____ (company) If no, explain</p> </td><td data-bbox="1266 1533 1503 1747"> <p align="right"><input type="checkbox"/> YES <input type="checkbox"/> NO</p> </td></tr> </table>	<p>New underground piping flushed according to approved flushing procedure dated _____ by _____ (company) If no, explain</p>	<p align="right"><input type="checkbox"/> YES <input type="checkbox"/> NO</p>	<p>How flushing flow was obtained <input type="checkbox"/> Public Water <input type="checkbox"/> Tank or Reservoir <input type="checkbox"/> Fire pump</p>	<p>Through what type opening <input type="checkbox"/> Hydrant butt. <input type="checkbox"/> Open pipe Give C factors and pitot readings in comment section.</p>	<p>Lead-ins flushed according to approved flushing procedure dated _____ by _____ (company) If no, explain</p>	<p align="right"><input type="checkbox"/> YES <input type="checkbox"/> NO</p>
<p>New underground piping flushed according to approved flushing procedure dated _____ by _____ (company) If no, explain</p>	<p align="right"><input type="checkbox"/> YES <input type="checkbox"/> NO</p>						
<p>How flushing flow was obtained <input type="checkbox"/> Public Water <input type="checkbox"/> Tank or Reservoir <input type="checkbox"/> Fire pump</p>	<p>Through what type opening <input type="checkbox"/> Hydrant butt. <input type="checkbox"/> Open pipe Give C factors and pitot readings in comment section.</p>						
<p>Lead-ins flushed according to approved flushing procedure dated _____ by _____ (company) If no, explain</p>	<p align="right"><input type="checkbox"/> YES <input type="checkbox"/> NO</p>						

Project Title: ICDF Landfill and Evaporation Pond RD/CWP – Title II

Document Type: Technical Specifications

SPC Number: 1476

Revision Number: 2

	How flushing flow was obtained <input type="checkbox"/> Public Water <input type="checkbox"/> Tank or Reservoir <input type="checkbox"/> Fire pump	Through what type opening <input type="checkbox"/> Y conn. To flange and spigot <input type="checkbox"/> Open pipe
HYDROSTATIC TEST	All new underground piping hydrostatically tested at Joints covered psi for hours <input type="checkbox"/> YES <input type="checkbox"/> NO	
LEAKAGE TEST	Total amount of leakage measured gals hours	
	Allowable leakage gals hours	
HYDRANTS	Number installed	Type and Make All operate satisfactorily <input type="checkbox"/> YES <input type="checkbox"/> NO
CONTROL VALVES	Water control valves left wide open <input type="checkbox"/> YES <input type="checkbox"/> NO If no, state reason Hose threads of fire department connections and <input type="checkbox"/> YES <input type="checkbox"/> NO hydrants interchangeable with those of fire department answering alarm.	
REMARKS	Date left in service	
SIGNATURES	Name of installing Contractor	
	Tests Witnessed By	
	For Operating Contractor	Title Date
	For Installing Contractor	Title Date

Project Title: ICDF Landfill and Evaporation Pond RD/CWP – Title II
Document Type: Technical Specifications
SPC Number: 1476
Revision Number: 2

Additional Explanation and Notes

1

1 SECTION 15992--PIPING LEAKAGE TESTING

2
3 PART 1--GENERAL (NOT USED)

4
5 PART 2--PRODUCTS (NOT USED)

6
7 PART 3--EXECUTION

8
9 PREPARATION:

10
11 Notify BBWI Construction Manager in writing 5 days in advance of testing. Perform testing
12 in presence of BBWI Construction Manager.

13
14 Pressure Piping:

15
16 Install temporary thrust blocking or other restraint as necessary to protect adjacent
17 piping or equipment and make taps in piping prior to testing.

18
19 Prior to test, remove or suitably isolate appurtenant instruments or devices that could
20 be damaged by pressure testing.

21
22 Items that do not require testing include: Piping between wetwells and wetwell
23 isolation valves, tank overflows to atmospheric vented drains, tank atmospheric vents,
24 and perforated piping.

25
26 Test section may be filled with water and allowed to stand under low pressure prior to
27 testing.

28
29 Gravity Piping:

30
31 Perform testing after service connections, manholes, and backfilling have been
32 completed between stations to be tested.

33
34 Determine groundwater level at time of testing by exploratory holes or other method
35 acceptable to BBWI Construction Manager.

36
37 HYDROSTATIC TEST:

38
39 General: Hydrostatic testing shall be performed on all single-wall pipe, inner carrier pipes,
40 and all PVC piping.

41
42 Fluid: Clean water of such quality to prevent corrosion of materials in piping system.

1 Test Pressure:

2
3 Gravity Piping: Per Section 15060, PIPING—GENERAL.

4
5 Pressure Piping: Per Section 15060, PIPING—GENERAL.

6
7 Exposed Piping:

8
9 Perform testing on installed piping prior to application of insulation.

10
11 Maximum Filling Velocity: 0.25 feet per second, applied over full area of pipe.

12
13 Vent piping during filling. Open vents at high points of piping system or loosen
14 flanges, using at least four bolts, or use equipment vents to purge air pockets.

15
16 Maintain hydrostatic test pressure continuously for 30 minutes, minimum, and for
17 such additional time as necessary to conduct examinations for leakage. No fluid shall
18 be added to the system, and system shall not drop below 95 percent of the test
19 pressure during the test period.

20
21 Examine exposed joints and connections for leakage.

22
23 No leakage allowed. Correct visible leakage and retest as specified.

24
25 Empty pipe of water prior to final cleaning or disinfection.

26
27 Buried Piping:

28
29 Pipe with Welded, Glued, or Fusion Bonded Joints:

30
31 Test piping using the same procedure as outlined for exposed piping as
32 modified above.

33
34 After filling pipe with test fluid, allow the pipe to sit for 24 hours for the fluid
35 temperature to stabilize.

36
37 Test pressure shall not drop below 98 percent of the initial test pressure during
38 a 1-hour test period.

39
40 Examine exposed joints and connections for leakage.

41
42 No leakage allowed. Correct visible leakage and retest as specified.

43
44 Empty pipe of water prior to final cleaning or disinfection.

Pipe with Gasketed Joints:

Test after backfilling, as specified in Section 02320, TRENCH BACKFILL, has been completed.

Expel air from piping system during filling.

Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.

Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure.

Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.

Maximum Allowable Leakage:

$$L = \frac{SD(P)^{1/2}}{133,200}$$

where:

L = Allowable leakage, in gallons per hour.

S = Length of pipe tested, in feet.

D = Nominal diameter of pipe, in inches.

P = Test pressure during leakage test, in pounds per square inch.

Correct leakage greater than allowable, and retest as specified.

PNEUMATIC TEST:

General: Pneumatic testing shall be performed for outer pipe of double-wall HDPE piping.

Double-Wall Pipe: Inner carrier pipe shall be full of water when outer containment pipe is tested to prevent damage to carrier pipe.

Equipment:

Calibrate gauges with standardized test gauge provided by Construction Manager at start of each testing day. Construction Manager will witness calibration.

Install gauges, air piping manifolds, and valves at ground surface.

1 Provide pressure release device, such as rupture disc or pressure relief valve, to
2 relieve pressure at 5 psi or less.

3
4 Restrain plugs used to close lines to prevent blowoff.

5
6 Procedure:

7
8 Require that no person enter manhole where pipe is under pressure.

9
10 Slowly introduce air into pipe section until internal air pressure reaches required test
11 pressure.

12
13 Allow 2 minutes minimum for air temperature to stabilize.

14
15 Examine exposed joints and connections for leakage.

16
17 No leakage allowed. Correct visible leakage and retest as specified.

18
19 Defective Piping Sections: Replace or test and seal individual joints, and retest as specified.

20
21 END OF SECTION 15992

SECTION 16005--ELECTRICAL

PART 1--GENERAL

REFERENCES:

The following is a list of standards which may be referenced in this section:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C80.1	Rigid Steel Conduit-Zinc Coated.
ANSI C80.3	Electrical Metallic Tubing-Zinc Coated.
ANSI C80.5	Aluminum Rigid Conduit.
ANSI C80.6	Intermediate Metal Conduit (IMC)-Zinc Coated.

FEDERAL SPECIFICATIONS (FS)

FS W-C-596	Connector, Receptacle, Electrical.
FS W-S-896	Switches, Toggle, Flush Mounted.

NATIONAL ELECTRICAL CONTRACTOR'S ASSOCIATION, INC. (NECA)

NECA 5055	Standard of Installation.
-----------	---------------------------

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1	Molded Case Circuit Breakers and Molded Case Switches.
NEMA 250	Enclosures for Electrical Equipment (1,000 Volts Maximum).
NEMA ICS 2	Standard for Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts ac or 750 volts dc.
NEMA PB 1	Panelboards.
NEMA ST 20	Dry-Type Transformers for General Applications.
NEMA TC 2	Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
NEMA TC 3	PVC Fittings for Use with Rigid PVC Conduit and Tubing.
NEMA WD 1	General Requirements for Wiring Devices.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	National Electrical Code (NEC).
NFPA 72	Fire Alarm Code.

1 UNDERWRITERS LABORATORIES, INC. (UL)

- 2
- 3 UL 1 Standard for Safety Flexible Metal Conduit.
- 4 UL 651 Standard for Safety Schedule 40 and 80 PVC Conduit.
- 5 UL 845 Standard for Safety Motor Control Centers.
- 6 UL 1561 Standard for Dry-Type General Purpose and Power Transformers.
- 7

8 UL COMPLIANCE:

9

10 Materials manufactured within scope of Underwriters Laboratories shall conform to UL
11 Standards and have an applied UL listing mark.

12

13 ELECTRICAL DESCRIPTION OF WORK:

14

15 Provide and install power conduits and cables to electrical service gear for each crest pad
16 building. Power conduits and cables shall route from crest pad building electrical service gear
17 to utility power manhole provided by INEEL and as shown on Drawings.

18

19 Provide and install communication conduits and cables for each crest pad building
20 communication service. Communication conduits and cables shall route below grade from
21 crest pad building communication panel (i.e., pump control, paging, fire alarm) to utility
22 communication manholes provided by INEEL and as shown on Drawings.

23

24 Provide and install electrical service gear for each crest pad building including: motor control
25 center (MCC), MCC integrally mounted lighting panel and transformer, and grounding
26 electrode system.

27

28 Motor control center shall provide 480V, three-phase, 3-wire power to pump motors,
29 building heaters, and control panel with motor starters.

30

31 Lighting panel and transformer shall provide 208/120V, three-phase, 4-wire power for
32 instruments, lighting, receptacles, small motor loads, and miscellaneous panels.

33

34 Provide and install grounding electrode system at each crest pad building. Bond service gear,
35 lighting transformer, power and communication panels, and building metal structures to
36 grounding electrode system.

37

38 Provide and install power conduits and cables to the following three-phase equipment:

39

40 Crest pad building unit heaters.

41

42 Crest pad building air conditioning units.

43

44 Crest pad building generator plugs and receptacles.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45

- Landfill leachate collection and leak detection recovery system pumps.
- Evaporation pond leak detection recovery system pumps.
- Combined sump pump.
- Transfer pump.

Provide and install power conduits and cables to the following single-phase equipment:

- Crest pad building interior and exterior lighting.
- Crest pad building receptacles.
- Crest pad building control and alarm panels.
- Crest pad building voice pager panels.
- Crest pad building fire alarm panels.

Provide and install control and signal conduits and cables to the following instrumentation:

- Crest pad building temperature transmitters.
- Crest pad building sump level floats and panels.
- Crest pad building fire detector and manual pull stations.
- Crest pad building ventilation thermostats.
- Landfill leachate collection and leak detection recovery system pump flow meters and submersible pressure transmitters.
- Evaporation pond leak detection recovery system pump flow meters and submersible pressure transmitters.
- Landfill leachate collection carrier pipe leak detection level switches.
- Evaporation pond truck loading flow meters and transmitters.
- Evaporation pond combined sump and SSSTF wastewater flow meters.
- Raw water flow meter and transmitter.

Truck loading flow meter and transmitter.

SSSTF line VARV high level float.

ENVIRONMENTAL CONDITIONS:

Provide equipment and conduit systems approved for installing in the following environmental conditions:

Climatic and Geographic Site Conditions:

Site Elevation: 4,917 feet.

Barometric Pressure: 12.27 psia.

Relative Humidity: 90 percent maximum at 30 degrees F dry bulb, 15 percent minimum at 60 degrees F dry bulb.

Uniform Building Code: Seismic Zone 2B.

Temperature: +40 degrees C max. -40 degrees C min.

Provide NEMA 3R enclosures for all outdoor equipment and NEMA 12 and NEMA 4X for all indoor equipment as noted on Drawings and in this Section.

Labeling: Install permanent labels on all electrical panels, cabinets, disconnects, motor starters, major equipment or components, receptacles, and switches.

PART 2--PRODUCTS

GENERAL:

Products shall comply with all applicable provisions of NFPA 70.

Like Items of Equipment: End products of one manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's service.

Equipment and Devices Installed Outdoors or in Unheated Enclosures: Capable of continuous operation within ambient temperature range of -40 degrees C to +40 degrees C.

Corrosive Areas: Products shall be acceptable to the regulatory authority having jurisdiction for the corrosive area indicated.

Hazardous Areas: Products shall be acceptable to the regulatory authority having jurisdiction for the combined sump area. Class 1, Division I.

Equipment Finish: Manufacturer's standard finish color, except where specific color is indicated.

SERVICE ENTRANCE:

Meet requirements of Operating Contractor.

Provide conduits and pull boxes to facilitate routing of power and telephone telemetry to new station.

LIGHTING AND POWER DISTRIBUTION PANELBOARD:

NEMA PB 1, NFPA 70, and UL 67.

Panelboards and Circuit Breakers: Suitable for use with 75 degrees C copper wire at full NFPA 70, 75 degrees C ampacity.

Short-Circuit Current Equipment Rating: Fully rated; series connected unacceptable.

Rating: Applicable to a system with available short-circuit current of 10,000 amperes rms symmetrical at 120/208 volts.

Ground Fault Circuit Interrupter (GFCI): UL Class A GFCI, 5-mA trip, 10,000-amp interrupting capacity circuit breakers.

Ground Fault Equipment Protection (GFEP): 30-mA trip, 10,000-amp interrupting capacity circuit breaker, UL listed for equipment ground fault protection.

Interior Panelboard:

NEMA 250, Type 12 unless otherwise noted.

Material: Code-gauge, hot-dip galvanized sheet steel, with reinforced steel frame.

Wiring Gutter: Minimum 4 inches square; both sides, top and bottom.

Front: Fastened with adjustable clamps.

Interior:

Factory assembled; complete with circuit breakers.

Capable of circuit breaker replacement without disturbing adjacent circuit breakers or without removing main bus.

Spaces: Cover openings with easily removable metal cover.

Circuit Directory: Metal frame with transparent plastic face and enclosed card on interior of door.

Bus Bar:

Material: Copper and/or tin-plated copper full sized throughout length.

Provide for mounting of future circuit breakers along full length of bus regardless of number of units and spaces shown. Machine, drill, and tap as required for current and future positions.

Neutral: Insulated, rated same as phase bus bars, with at least one terminal screw for each branch circuit.

Neutral bus with at least two (neutral and ground) terminal screws for each circuit.

Note: Do not install multiwire branch circuits that share common neutral. Install neutral for each 120-volt branch circuit.

Lugs and Connection Points:

Suitable for copper conductors.

Solderless main lugs for main, neutral, and ground bus bars.

Bolt together and rigidly support bus bars and connection straps on molded insulators.

Circuit Breakers:

NEMA AB 1 and UL 489.

Thermal-magnetic, quick-make, quick-break, molded case, of indicating type showing ON/OFF and TRIPPED positions of operating handle.

Noninterchangeable, in accordance with NFPA 70.

Locking: Provisions for handle padlocking, unless otherwise shown.

Type: Bolt-on circuit breakers in all panelboards.

Multipole circuit breakers designed to automatically open all poles when an overload occurs on one pole.

Do not substitute single-pole circuit breakers with handle ties for multipole breakers.

Do not use tandem or dual circuit breakers in normal single-pole spaces.

Ground Fault Circuit Interrupter (GFCI):

Equip with conventional thermal-magnetic trip and ground fault sensor rated to trip in 0.025 second for a 5-mA ground fault (UL 943, Class A sensitivity).

Sensor with same rating as circuit breaker and a push-to-test button.

Manufacturers:

Allen-Bradley.

Cutler-Hammer/Westinghouse.

General Electric.

Square D.

LIGHTING AND POWER DISTRIBUTION STEPDOWN TRANSFORMER (0-600 VOLTS):

Type: Self-cooled, two-winding.

UL 1561 and NEMA ST 20.

Insulation Class/Temperature Rise: 115 Degrees F.

Core and Coil:

30 kVA or Less: Encapsulated.

Voltage Taps: Full capacity, 2-1/2 percent, two above and two below normal voltage rating.

Sound Level: Not to exceed NEMA ST 20 levels.

Vibration isolators to minimize and isolate sound transmission.

Project Title: ICDF Landfill and Evaporation Pond RD/CWP – Title II

Document Type: Technical Specifications

SPC Number: 1476

Revision Number: 2

1 Manufacturers:

2
3 Allen-Bradley.

4
5 Cutler-Hammer/Westinghouse.

6
7 General Electric.

8
9 Square D.

10
11 CONTROL PANELS:

12
13 Enclosure:

14
15 NEMA 250, Type 12 unless otherwise noted.

16
17 Minimum Metal Thickness: 14 gauge.

18
19 Doors: Rubber gasketed with continuous hinge.

20
21 Incandescent Light: Hand switch controlled, 100-watt.

22
23 Receptacle: Breaker protected 120-volt, 15-amp duplex.

24
25 Finish: Internal and external surfaces:

26
27 Sand panel; remove mill scale, rust, grease, and oil.

28
29 Fill imperfections and sand smooth.

30
31 Paint with one coat of epoxy coating metal primer, two finish coats of
32 two-component type epoxy enamel.

33
34 Sand surfaces lightly between coats.

35
36 Final Dry Film Thickness: Minimum 3 mils.

37
38 Size panels to adequately dissipate heat generated by equipment mounted in or on
39 panel.

40
41 Manufacturers:

42
43 Hoffman.

44
45 H. F. Cox.

Wiring:

Power and Control Wiring: 600-volt class, insulated, stranded copper.

Size: Minimum No. 14 AWG enclosed in either sheet metal raceway or plastic wiring duct.

Signal Circuit Wiring: Twisted shielded pairs minimum No. 16 AWG, separated at least 6 inches from power wiring.

Identification: Permanent heat impregnated polyvinyl chloride (PVC) alpha-numeric labels.

SAFETY SWITCHES:

Type: Visible blade, fusible.

Class: Heavy-duty.

Enclosures:

Indoor Installations: NEMA 250, Type 4X.

Outdoor Installations: NEMA 250, Type 3R raintight.

CIRCUIT BREAKERS:

NEMA AB 1.

Indicating type, with ON/OFF and TRIPPED positions of the operating handle.

Bolt-on thermal-magnetic, quick-make, quick-break noninterchangeable.

Tandem or dual circuit breakers in normal single-pole spaces not permitted.

SPECIAL RACEWAYS: MULTI-CELL PVC RACEWAY

General: UL listed Multiple Celled raceway system utilizing pre-lubricated PVC inner-ducts for installation of voice, data, video and other low voltage cabling.

System Description: Industry standard communication outer ducts and inner ducts meeting the performance requirements of this specification. Fixed and flexible bends shall be allowed for changes in direction. A gasket coupling mechanism shall be provided with terminators for field assembly without lubricants.

All materials shall be furnished by the same manufacturer.

Materials:

Outer-Duct: PVC outer-duct with printline stating “INSTALL PRINTLINE UP.”

Type 40 UL listed for direct burial and concrete encasement.

Standard and heavy wall construction shall consist of fiberglass-reinforced epoxy for mechanical and UV protection.

Outer-Duct Performance Requirements:

Minimum Stiffness: 72 degree F: 370 lbs/in/in.

Minimum Bell OD: 5.00 inches.

Outer-Duct OD: 4.50 inches.

Impact Values: 72 Degrees F: 220 ft/lbs.

Maximum Joint Insertion Force: 80 lbs.

Maximum Joint Separation Force: 200 lbs.

Minimum Joint Water Infiltration: 11 PSI.

Minimum Lay Length: 20 feet.

Flexible Bend Minimum Radius: 4 feet.

Inner-Duct: Three-cell Type 40 multi-colored inner-ducts provided as (three-cell white/gray/orange). PVC inner-ducts in straight length shall be pre-lubricated. One white inner-duct shall be under the print line with other inner-ducts being gray. Inner-ducts shall not cut through when subject to 1/4-inch polypropylene rope pulled at 100 ft/min and at 45-pound tension for 100 minutes as tested in accordance with Bellcore procedures.

A non-cemented spacer system shall be installed in the outer-duct to hold all three-cell inner-ducts in a triangular configuration.

Inner-Duct Performance Requirements:

Minimum Stiffness: 72 degree F: 140 lbs./in/in.

Minimum OD: 4.50 inches.

Inner-Duct OD: 1.66 inches.

Inner-Duct ID: 1.50 inches.

Air Burst Pressure Rating: 200 PSI.

COF Requirements TSY-356: .06-.09 pass.

Cut-Through-Testing TSY-356: 100 min pass.

Flexible Bend Minimum Radius: 4 feet.

PVC Multi-Cell Fixed Bends with Bell: Multi-guard fixed bends, which use the same coupling design as straight section. All bends shall be provided with plastic inner-ducts to avoid rope cut-through.

PVC Multi-Cell Flexible Bends with Bell: Multi-guard flexible bends capable of a 4-foot minimum bend radius and use the same coupling design as straight section. All bends shall be provided with plastic inner-ducts to avoid rope cut-through.

Accessories: Provide slip couplings to allow male-to male connections, termination kits for vaults, handholes and enclosures, and line blowing kits.

Manufacturers and Product Number: Carlon Systems Multi-Gard; MFSS3S-020-C.

CONDUIT AND FITTINGS:

Rigid Galvanized Steel Conduit (RGS):

ANSI C80.1.

Fittings: Threaded type.

Galvanize by hot-dipping, electroplating, sherardizing, or metalizing process, including fittings.

Polyvinyl Chloride Conduit (PVC):

Rigid, Schedule 40, NEMA TC 2.

UL 651 listed for concrete encased, direct burial, concealed and direct sunlight exposed use.

UL 651 listed and marked for use with conductors having 90 degrees C insulation.

Fittings: NEMA TC 3, for intended use.

Flexible Metal Liquid-Tight Conduit:

UL 1 listed for liquid-tight service.

Galvanized steel, flexible conduit covered with extruded PVC jacket.

Termination: Nylon bushings or bushings with steel or malleable iron body and insulated throat and sealing O-ring.

Conduit Sealing Fitting:

Restrict the passage of gasses, vapors, or flames from one portion of the electrical installation to another at atmospheric pressure and normal ambient temperatures.

In conduit systems when leaving Class 1, Division 1 or Division 2 hazardous locations.

Manufacturers and Products:

Appleton; Type EYF, EYM, or ESU.

Crouse-Hinds; Type EYS or EZS.

Fitting Sealing Compound: Form a seal around each electrical conductor and between them and inside of the sealing fitting to restrict the passage of gases, vapors, or flames through the sealing fitting.

Manufacturers and Products:

Appleton; Kwiko.

Crouse-Hinds; Chico.

SUPPORT AND FRAMING CHANNELS:

Carbon Steel Framing Channel:

Material: Rolled, mild strip steel, 12-gauge, ASTM A570, Grade 33.

Finish: Hot-dip galvanized after fabrication.

Paint-Coated Framing Channel: Carbon steel framing channel with electro-deposited rust inhibiting acrylic or epoxy paint.

Manufacturers:

B-Line Systems, Inc.

Unistrut Corp.

Aickinstrut.

PRECAST HANDHOLES:

Concrete Strength: Minimum 3,000 psi compressive, in 28 days.

Loading: AASHTO H-20, in accordance with ASTM C857.

Drainage: Slope floors toward drain points, leaving no pockets or other nondraining areas.

Raceway Entrances:

Provide on all four sides along with pulling eyes.

For raceways to be installed under this Contract, provide knockout panels or precast individual raceway openings.

At entrances where raceways are to be installed by others, provide minimum 12-inch high by 24-inch wide knockout panels for future raceway installation.

Handhole Frames and Covers:

Material: Steel, hot-dipped galvanized.

Cover Type: Solid, torsion spring of checkered diamond design.

Cover Loading: AASHTO H-20.

Cover Designation: Burn by welder, on upper side in integral letters, minimum 2 inches in height, appropriate titles:

600 Volts and Below: ELECTRIC LV.

TELEPHONE.

Project Title: ICDF Landfill and Evaporation Pond RD/CWP – Title II
Document Type: Technical Specifications
SPC Number: 1476
Revision Number: 2

Hardware: Steel, hot-dip galvanized.

Furnish knockout for ground rod in each handhole.

Manufacturers:

Utility Vault Co.

Penn-Cast Products, Inc.

Concrete Conduit Co.

Associated Concrete Products, Inc.

Pipe, Inc.

CONDUCTORS:

Material: Annealed copper.

Insulation:

No. 8 AWG and Smaller: Type THHN/THWN.

No. 6 AWG and Larger: Type XHHW.

Direct Buried: Type XLPE-USE.

Flexible Cord and Cable: Type SO, 600 volts.

Signal: Type 3, No. 16 AWG twisted, shielded pair instrumentation cable, 45-mil PVC outer jacket, 600-volt rating.

Type:

Control Conductor No. 14 AWG and Smaller: Stranded.

Power Conductors No. 10 AWG and Smaller: Solid or stranded.

Power Conductors No. 8 AWG and Larger: Stranded.

Type 3: No. 16 AWG stranded (copper seven-stranded)

1 TERMINAL BLOCKS AND ENCLOSURES:

2
3 Provide NEMA 4X enclosures for all indoor and outdoor terminal block applications.

4
5 Type: Compression screw clamp, with current bar providing direct contact with wire and
6 yoke, with individual rail mounted terminals.

7
8 Yokes and Clamping Screws: Zinc-plated, hardened steel.

9
10 Rating: 600V ac.

11
12 PUSHBUTTONS AND SELECTOR SWITCHES:

13
14 NEMA ICS 2, Type 600.

15
16 Type: Heavy-duty, oiltight.

17
18 Lockout: Pushbuttons and selector switches shall lock in OFF position wherever lockout
19 provisions are indicated.

20
21 Nameplates:

22
23 Individual, large, laminated plastic.

24
25 Function indicated.

26
27 Pushbutton station nameplates shall indicate the drive controlled.

28
29 Manufacturers and Models:

30
31 Allen-Bradley; 800E.

32
33 Square D; Type T.

34
35 Cutler-Hammer; Type 10250T.

36
37 LUMINAIRES:

38
39 Specific requirements relating to fixture type, lamp type, and mounting hardware is located
40 in the Luminaire Schedule attached to this section.

41
42 RECEPTACLES:

43
44 NEMA WD 1 and FS W-C-596.

1 Specification Grade:

2
3 Type: Three-wire grounding, with screw type terminals suitable for No. 10 AWG
4 wire. Contact to be made on two sides of each inserted blade without detent.

5
6 Number of Poles: Two.

7
8 Rating: 125 volts, NEMA WD 1, Configuration 5-20R, 20 amps.

9
10 Base: Phenolic composition.

11
12 Color: Gray.

13
14 SPECIAL RECEPTACLE AND PLUG:

15
16 Specification Grade:

17
18 Type: Three-wire, grounding Style 2.

19
20 Number of Poles: Four.

21
22 Rating: 100 amps, 600V ac.

23
24 Color: Gray.

25
26 Manufacturers and Products:

27
28 Crouse-Hinds:

29
30 Receptacle Assembly: AR.

31
32 Plug: APJ.

33
34 Appleton:

35
36 Receptacle Assembly: ADJA.

37
38 Plug: ACP.

39
40 SWITCHES:

41
42 NEMA WD 1 and FS W-S-896E.

43
44 Totally enclosed, ac type, quiet tumbler switches, with screw terminals.

1 Capable of control of 100 percent tungsten filament and fluorescent lamp loads.

2
3 Rating: 20 amps, 120/277 volts (single and double-pole as required).

4
5 Color: Gray.

6
7 BOXES:

8
9 Small Standard Boxes:

10
11 NEMA 250, Type 1, minimum 2 inches deep, unless shallower required by structural
12 conditions.

13
14 Large Galvanized Steel Boxes:

15
16 NEMA 250, Type 12 unless otherwise noted.

17
18 14-gauge, with full access screw covers mounted with corrosion-resistant machine
19 screws.

20
21 Large Cast Metal Boxes:

22
23 NEMA 250, Type 4, cast malleable iron, with hot-dip galvanized finish.

24
25 Neoprene gasketed, watertight, with cast metal covers, stainless steel screws, and
26 drilled and tapped conduit entrances.

27
28 Handholes:

29
30 Reinforced cast concrete boxes sized to provide adequate working space as required
31 by standard procedures and NFPA 70.

32
33 Nonmetallic:

34
35 Box: PVC.

36
37 Cover: PVC, weatherproof, with stainless steel screws.

38
39 Manufacturer and Product: Carlon; Type FS or FD, with Type E98 or E96 covers.

40
41 Large Nonmetallic Box:

42
43 NEMA 250, Type 4X.

Box: High-impact, fiberglass-reinforced polyester or engineered thermoplastic, with stability to high heat.

Cover: Hinged with clamps.

Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.

Conduit hubs and mounting lugs.

Manufacturers and Products:

Crouse-Hinds; Type NJB.

Carlson; Series N, C, or H.

Robroy Industries.

COVER PLATES:

Metal:

Material: Specification grade, one-piece, stainless steel.

Thickness: Minimum 0.40-inch nominal.

Finish: No. 302/304 satin.

Mounting Screws: Oval head, stainless steel, to match plate.

Cast Metal:

Material: Malleable ferrous, with gaskets.

Mounting Screws: Oval head, stainless steel.

Weatherproof Device Plates:

Material: Cast metal, gasketed, weatherproof, with individual cap over each opening held with stainless steel springs.

Finish: Stainless steel or fiberglass reinforced plastic.

Mounting Screws: Stainless steel.

1 GROUNDING:

2
3 General:

4
5 Grounding shall be in compliance with NFPA 70 and ANSI C2.

6
7 Ground electrical service neutral at service entrance equipment to supplementary
8 grounding electrodes.

9
10 Ground each separately derived system neutral to nearest effectively grounded
11 building structural steel member or separate grounding electrode.

12
13 Bond together system neutrals, service equipment enclosures, exposed
14 noncurrent-carrying metal parts of electrical equipment, metal raceways, ground
15 conductor in raceways and cables, receptacle ground connections, and metal piping
16 systems.

17
18 Shielded Instrumentation Cables:

19
20 Ground shield of instrumentation cables at PLC end only, using drain wire
21 connected to terminal block that is connected to an isolated instrument
22 ground. Isolated instrument ground terminals block is located inside PLC
23 control panel enclosure.

24
25 Insulate ungrounded end of all shielded instrumentation cables' shield with
26 shrink tubing for a distance of 1/2 inch either side of the end of the outer
27 jacket.

28
29 Wire Connections:

30
31 Ground Conductors: Install in conduit containing power conductors and control
32 circuits.

33
34 Nonmetallic Raceways and Flexible Tubing: Install equipment grounding conductor
35 and bond at both ends.

36
37 Connect ground conductors to raceway grounding bushings.

38
39 Bond all equipment grounding conductors to equipment ground bus and equipment
40 enclosures as required by the NEC.

41
42 Bolt connections to equipment ground bus.

43
44 Bond grounding conductors to metallic enclosures at each end, and to intermediate
45 metallic enclosures.

Junction Boxes: Furnish materials and connect to equipment grounding system with grounding clips mounted directly on box, or with 3/8-inch machine screws.

Motor Grounding:

Extend equipment ground bus via grounding conductor installed in motor feeder raceway; connect to motor frame.

Nonmetallic Raceways and Flexible Tubing: Install an equipment grounding conductor and bond at both ends.

Motors Less Than 10 hp: Furnish compression, spade-type terminal connected to conduit box mounting screw.

Motors 10 hp and Above: Tap motor frame or equipment housing; furnish compression, one-hole, lug type terminal connected with minimum 5/16-inch brass threaded stud with bolt and washer.

Circuits 20 Amps or Above: Tap motor frame or equipment housing; install solderless terminal with minimum 5/16-inch diameter bolt.

Grounding Conductors:

Equipment: Solid or stranded copper with green, Type USE/RHH/RHW-XLPE or THHN/THWN, insulation.

Direct Buried: Bare stranded copper.

Isolated Instrument Ground: Stranded copper with green insulation with yellow stripe or yellow phasing tape at all ends.

Ground Rod:

Material: Copper.

Diameter: Minimum 3/4 inch.

Length: 10 feet.

Connectors:

Exothermic Weld Type:

Outdoor Weld: Suitable for exposure to elements or direct burial.

Indoor Weld: Utilize low-smoke, low-emission process.

Manufacturers: Erico Products, Inc., Cadweld and Cadweld Exolon.

Compression Type:

Compress-deforming type; wrought copper extrusion material.

Single indentation for conductors 6 AWG and smaller.

Double indentation with extended barrel for conductors 4 AWG and larger.

Barrels prefilled with oxide-inhibiting and antiseizing compound and sealed.

Manufacturers:

Burndy Corp.

Thomas and Betts Co.

ILSCO Corp.

Mechanical Type: Split-bolt, saddle, or cone screw type; copper alloy material.

Manufacturers:

Burndy Corp.

Thomas and Betts Co.

ILSCO Corp.

Grounding Wells:

Ground rod box complete with cast iron riser ring and traffic cover marked
GROUND ROD.

Manufacturers and Products:

Christy Co.; No. G5.

Lightning and Grounding Systems, Inc.; I-R Series.

1 VOICE PAGER AND FIRE ALARM SYSTEM FPCP-1,-2, ECS-CD-1798,-1799:

2
3 Provide and install inside each Crest Pad Building the following voice pager and fire alarm
4 system compatible with existing INEEL systems:

5
6 Fire Alarm Detectors(two each minimum per building): System Sensor Model 2151
7 with Model B401B face.

8
9 Manual Fire Alarm Pull Boxes (one each per building): Manual fire alarm pull boxes
10 shall be double-action type with single-pole double-throw contacts mounted on a
11 back box. Note: "Break Glass" types are not acceptable.

12
13 Audible Visual Occupant Notification Device (one each per building): System Sensor
14 Model P24(Cd rating) for wall-mounted units. Audible devices shall be UL 464 listed
15 and visual devices shall be UL 1971 listed.

16
17 Fire Alarm and Voice Pager (one each per building): Digital Alarm Communications
18 Transmitter (DACT) shall be an Firelite Model 911 which will communicate over
19 standard dial tone circuits with an Ademco Model 685 DACR using Radionics BFSK
20 communications protocol located in the Fire Alarm Center in CFA 666. The DACT
21 shall be UL listed.

22
23 Wire all components in accordance with manufacturing requirements and INEEL applicable
24 standards. Provide 120V ac power to fire alarm and voice pager panel. Integrate fire alarm
25 and voice pager system into PICS control panel as shown.

26
27 PART 3--EXECUTION

28
29 GENERAL:

30
31 All work shall be performed in a neat and workman-like manner and shall comply with all
32 applicable provisions of NECA 5055 standards and practices.

33
34 Install materials and equipment in corrosive areas in a manner acceptable to regulatory
35 authority having jurisdiction for the corrosive area indicated.

36
37 Ground equipment, enclosures, and complete conduit system securely in accordance with
38 applicable sections of NFPA 70.

39
40 MOTOR STARTER:

41
42 Field adjust trip settings of motor starter magnetic, trip-only circuit breakers in accordance
43 with manufacturer's instructions.

CONDUIT AND FITTINGS:

General:

Conduit system shall be carefully planned with proper attention to details before starting the work.

Do not install crushed or deformed raceways. Replace any raceway that has been damaged after installation.

Raceways that are installed so as to form a moisture trap are not allowed.

Prevent plaster, dirt, or trash from lodging in raceways, boxes, fittings, and equipment during the course of construction. Clear clogged raceways of obstructions.

All conduit runs shall be made parallel to or perpendicular to the lines of the building.

Secure conduits entering cabinets, pull boxes or outlet boxes with galvanized locknuts and bushings, on both sides of box wall.

Applications:

Exposed Exterior: Type RGS.

Concrete Embedded: Type PVC.

Direct Buried: Type PVC.

Vertical Runs Through Slab: Convert PVC conduit to RGS wrapped with plastic tape.

PVC Bends: Bends in PVC runs shall be incorporated using RGS.

Final Connection to Motors:

Conduit Size 4 Inches or Less: 18-inch minimum, 60-inch maximum length of flexible liquid-tight metal conduit.

Penetrations:

Conduits penetrating fire-rated walls shall be sealed with a compound approved by UL and INEEL, and appropriate to the fire rating of the wall.

Flash and counterflash conduits penetrating roofing membrane.

Seal penetrations with oakum or expandable plastic compound.

1
2 Provide sleeves and chases where conduits pass through floors or walls. Finish to
3 match adjacent surfaces.

4
5 Provide escutcheon plates where exposed conduits pass through walls, floors or
6 ceilings.

7
8 Conduits from the combined sump area penetrating the evaporation building walls
9 shall be sealed with a compound approved by UL and INEEL, and appropriate for
10 conduits in hazardous areas entering non-hazardous areas.

11
12 Slab-On-Grade or Direct Buried:

13
14 Install horizontal runs below floor slab. Horizontal runs within slab shall not be
15 permitted.

16
17 Field wrap RGS conduit and joints installed below slab or direct buried with
18 0.010-inch thick pipe wrapping plastic tape applied with a 50 percent overlay, or
19 factory apply a plastic resin, epoxy, or coal-tar coating system.

20
21 Exposed Raceways:

22
23 Install parallel or perpendicular to walls, structural members, or intersections of
24 vertical planes and ceilings.

25
26 Changes in Direction of Runs:

27
28 Make with symmetrical bends or cast metal fittings.

29
30 Bends and offsets shall be made with a hickey or conduit bending machine.

31
32 Supports:

33
34 Provide pipe straps, wall brackets, conduit clamps, conduit hangers, threaded
35 C-clamps with retainers, or ceiling trapeze.

36
37 Install suitable braces for conduit, junction boxes, light fixtures and other electrical
38 equipment as needed for seismic support.

39
40 Securely and rigidly fasten in place.

41
42 Maximum Interval: 10 feet.

1 CONDUCTORS:

2
3 Conduit system shall be complete prior to drawing conductors.

4
5 Lubricate prior to drawing into conduit. Lubrication type shall be as approved by conductor
6 manufacturer.

7
8 Connections: Pressure type solderless, complete with insulator and security ring.

9
10 Control Circuits:

11
12 Where multiple units perform parallel operations, do not group all devices on same
13 branch circuit.

14
15 Do not exceed the ampacity of the branch circuit, or 12 amperes continuous.

16
17 Terminate feeder and interconnecting conductors between panel mounted equipment
18 and external equipment at numbered terminal blocks.

19
20 Identification:

21
22 Where two or more conduits run to a single outlet box, color code each circuit as a
23 guide in making connections.

24
25 Carry colors continuously throughout the system.

26
27 Do not install multiwire branch circuits that share a common neutral.

28
29 Colors:

30
31 Neutral (Grounded Current Carrying Conductor): White (120/208V); Gray
32 (277/480V).

33
34 Ungrounded Current Carrying Conductor:

35
36 120/208-Volt System: Black (Phase A), red (Phase B), or blue
37 (Phase C).

38
39 277/480-Volt System: Yellow (Phase A), orange (Phase B), brown
40 (Phase C).

41
42 Ground Wire: Green.

43
44 DC System Conductors: DC⁺ (red), DC⁻ (black).

1 TERMINAL BLOCKS:

2
3 Install for termination of all control circuits leaving or entering equipment, panels, or boxes.

4
5 LUMINAIRES:

6
7 Install in accordance with manufacturer's recommendations.

8
9 Install plumb and true.

10
11 Provide swivel type hangers and canopies to match pendant mounted fixtures.

12
13 Furnish all lamps and clean the reflectors, the diffusers, and the lamps before closing up the
14 fixtures.

15
16 BOXES:

17
18 Support to the structure, independent of conduit attachment.

19
20 Boxes installed belowgrade shall be installed flush with finished grade.

21
22 Boxes and covers in paved areas, roadways, or walkways shall be suitable for weights to
23 which they may be subjected.

24
25 Box Extensions: Not permitted.

26
27 Corrosive Areas: Boxes shall be applicable for location and corrosive atmosphere present.

28
29 COVER PLATES:

30
31 Shall fit tightly to box.

32
33 Shall not extend beyond sides of box on surface mounted boxes, unless covers have no sharp
34 corners or edges.

35
36 TRENCH BACKFILL:

37
38 In accordance with Section 02320, TRENCH BACKFILL.

39
40 PROTECTION FOLLOWING INSTALLATION:

41
42 Protect materials and equipment from corrosion, physical damage, and the effects of moisture
43 on insulation.

44
45 Cap conduit runs during construction with manufactured seals.

1
2 Close openings in boxes or equipment during construction.

3
4 Energize space heaters furnished with equipment.

5
6 TESTING:

7
8 Circuit Balance:

9
10 Confirm the balance of electrical load between phases on panelboards and motor control
11 centers after installation.

12
13 Voltage Testing:

14
15 When installation is complete and facility is in operation, check voltage at point of
16 termination of electric supply system to project.

17
18 Check voltage amplitude and balance between phases for loaded and unloaded conditions.

19
20 Record supply voltage for 24 continuous hours. If unbalance exceeds 1 percent, or if voltage
21 varies throughout the day and from loaded to unloaded conditions more than plus or minus
22 4 percent of nominal, make written request to Operating Contractor to correct condition.

23
24 Equipment Line Current:

25
26 Check line current in each phase for each piece of equipment.

27
28 If electric utility makes adjustments to supply voltage magnitude or balance, make line
29 current check after adjustments are made.

30
31 Inspection of Low Voltage Cables, 600 Volts Maximum:

32
33 Inspect each individual exposed power cable for physical damage, proper connections in
34 accordance with single-line diagram and cable bends not in conformance with manufacturer's
35 minimum allowable bending radius where applicable.

36
37 Inspect shielded instrumentation cables for proper shield grounding, terminations, and circuit
38 identification

39
40 Inspect control cables for proper termination, and proper circuit identification.

41
42 Electrical Tests for Conductors:

43
44 Prior to final connection and energizing of power and control circuits, conduct an insulation
45 resistance test to determine insulation integrity

1
2 Utilize 1,000V dc megohmmeter for 600-volt insulated conductors and 500V dc
3 megohmmeter for 300-volt insulated conductors.

4
5 Test each conductor with respect to ground and to adjacent conductors per IEEE 118
6 procedures for 1 minute.

7
8 Evaluate ohmic values by comparison with conductors of same length and type.

9
10 Investigate values less than 50 megohms.

11
12 Continuity test by ohmmeter method to ensure proper cable connections.

13
14 Provide in spreadsheet format results of all inspection and testing for all cables. Conduit and
15 cable schedule attached as supplement to this specification will be provided to Contractor in
16 electronic format upon request.

17
18 Ground Electrode Test:

19
20 Inspect grounding connections prior to any backfill of cables.

21
22 Utilize Fall-of-Potential test in accordance with IEEE 81, Section 8.2.1.5, to measure ground
23 electrode system's resistance.

24
25 Maximum ground electrode resistance shall be 3 ohms. Add additional ground rods to
26 achieve maximum 3 ohms resistance.

27
28 SUPPLEMENTS:

29
30 The supplements listed below, following "END OF SECTION," are a part of this
31 Specification.

32
33 Supplement 1—Luminaire Schedule.

34
35 Supplement 2—Panel Schedule.

36
37 Supplement 3—Conduit and Cable Schedule.

38
39 END OF SECTION 16005

Project Title: ICDF Landfill and Evaporation Pond RD/CWP – Title II
Document Type: Technical Specifications
SPC Number: 1476
Revision Number: 2

LUMINAIRE SCHEDULE						
Type	Voltage	Description	Manufacturer	Catalogue No.	Lamp	Mounting Type
1	120	Heavy Duty Industrial 4-foot Fluorescent Fixture with 2 Lamps with Low Temp Starting Ballasts.	Holophane	7200-4-12-LT Fluorescent Prismatic or equal.	2- 40W R.S. T12, 0° F starting (48")	Pendant with Chains
2	120	Emergency Tungsten Light NiCaD Battery Operated.	Holophane	C1-6N-25-W-WCHY-2 Cortez AI	2-12 Watt 6-Volt Halogen	Wall Mount
3	120	WallPack Wall Mount HPS with Integral Photocell.	Holophane	WallPack WL2K-070HP-12-BK—F1-LAMP-PC	1-70W HPS	Wall Mount

PANEL: Evaporation Pond(s) Crest Pad Building LP-CD-2180											
VOLTAGE: 208/120 PHASE, WIRES: 3, 4 SCR (AMPS): 10,000 SOURCE: MCC			PANEL BUS: 100 AMPS MAIN: 60 BREAKER 125% OF MAX BUS LOAD: 30 AMPS TOTAL LOAD: 7.6 KVA			SERVICE RATED: NO NEUTRAL: BONDED MOUNTING: IN MCC FEED: TOP/BOTTOM					
DESCRIPTION	KVA	CB	CKT	A	B	C	CKT	CB	KVA	DESCRIPTION	
Interior Lighting	0.57	20/1	1	13.1			2	20/3	1.00	Air Conditioning Unit	
Exterior Lighting	0.70	20/1	3		14.2		4	-	1.00	Air Conditioning Unit	
Control Panel	1.50	20/1	5			20.8	6	-	1.00	Air Conditioning Unit	
Fire Alarm Panel	0.72	20/1	7	6.0			8	20/1	0.00	Spare	
Voice Pager	0.42	20/1	9		3.5		10	20/1	0.00	Spare	
Maintenance Outlets	0.36	20/1	11			3.0	12	20/1	0.00	Spare	
Maintenance Outlets	0.36	20/1	13	3.0			14	20/1	0.00	Spare	
Spare	0.00	20/1	15		0.0		16	20/1	0.00	Spare	
Spare	0.00	20/1	17			0.0	18	20/1	0.00	Spare	
TOTALS				22.1	17.7	23.8	AMPS				

PANEL: Landfill Crest Pad Building LP-CD-2182											
VOLTAGE: 208/120 PHASE, WIRES: 3, 4 SCR (AMPS): 10,000 SOURCE: MCC			PANEL BUS: 100 AMPS MAIN: 60 BREAKER 125% OF MAX BUS LOAD: 30 AMPS TOTAL LOAD: 7.7 KVA			SERVICE RATED: NO NEUTRAL: BONDED MOUNTING: IN MCC FEED: TOP/BOTTOM					
DESCRIPTION	KVA	CB	CKT	A	B	C	CKT	CB	KVA	DESCRIPTION	
Interior Lighting	0.61	20/1	1	13.4			2	20/3	1.00	Air Conditioning Unit	
Exterior Lighting	0.70	20/1	3		14.2		4	-	1.00	Air Conditioning Unit	
Control Panel	1.50	20/1	5			20.8	6	-	1.00	Air Conditioning Unit	
Fire Alarm Panel	0.72	20/1	7	6.0			8	20/1	0.00	Spare	
Voice Pager	0.42	20/1	9		3.5		10	20/1	0.00	Spare	
Maintenance Outlets	0.36	20/1	11			3.0	12	20/1	0.00	Spare	
Maintenance Outlets	0.36	20/1	13	3.0			14	20/1	0.00	Spare	
Spare	0.00	20/1	15		0.0		16	20/1	0.00	Spare	
Spare	0.00	20/1	17			0.0	18	20/1	0.00	Spare	
TOTALS				22.4	17.7	23.8	AMPS				

CONDUIT AND CABLE SCHEDULE

CONDUIT ID	EQUIPMENT NAME	FROM	TO	VIA	CONDUIT SIZE	CONDUIT TYPE	CABLE FILL	CABLE TYPE	VOLTAGE	DRAWING NUMBER	REMARKS
C001	MCC-CD-2181	INEL POWER MANHOLE	LANDFILL CREST PAD BUILDING MCC	BELOW GRADE	2"	PVC	3#12, 1#4G	XHHW-2	480V ac	E-201	
C002	MCC-CD-2180	INEL POWER MANHOLE	EVAPORATION POND(S) CREST PAD BUILDING MCC	BELOW GRADE	2"	PVC	3#12, 1#4G	XHHW-2	480V ac	E-201	
C003	CP-CD-950	INEL COMMUNICATION HANDHOLE	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	5"	PVC				E-201	Multi-Cell Raceway
C004	CP-CD-951	INEL COMMUNICATION HANDHOLE	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	5"	PVC				E-201	Multi-Cell Raceway
C005	FP-CP-1	INEL COMMUNICATION HANDHOLE	LANDFILL CREST PAD BUILDING FIRE PANEL	BELOW GRADE	2"	PVC				E-201	Install pull wire
C006	FP-CP-2	INEL COMMUNICATION HANDHOLE	EVAPORATION POND(S) CREST PAD BUILDING FIRE PANEL	BELOW GRADE	2"	PVC				E-201	Install pull wire
C007	ECS-CD-1799	INEL COMMUNICATION HANDHOLE	LANDFILL CREST PAD BUILDING VOICE PAGER	BELOW GRADE	2"	PVC				E-201	Install pull wire
C008	ECS-CD-1798	INEL COMMUNICATION HANDHOLE	EVAPORATION POND(S) CREST PAD BUILDING VOICE PAGER	BELOW GRADE	2"	PVC				E-201	Install pull wire
C009	DSW-CD-203-1	LANDFILL CREST PAD BUILDING MCC	LANDFILL LCRS HIGH FLOW PUMP DISCONNECT	BELOW GRADE	3/4"	RGS	3#12, 1#12G	THWN	480V ac	E-202	Combine cables
C010	DSW-CD-203-2	LANDFILL CREST PAD BUILDING MCC	LANDFILL LCRS LOW FLOW PUMP DISCONNECT	BELOW GRADE	3/4"	RGS	3#12, 1#12G	THWN	480V ac	E-202	Combine cables
C011	DSW-CD-204	LANDFILL CREST PAD BUILDING MCC	LANDFILL LCRS PUMP DISCONNECT	BELOW GRADE	3/4"	RGS	3#12, 1#12G	THWN	480V ac	E-202	
C012	DSW-CD-208	LANDFILL CREST PAD BUILDING MCC	LANDFILL SLDRS PUMP DISCONNECT	BELOW GRADE	3/4"	RGS	3#12, 1#12G	THWN	480V ac	E-202	
C013	UH-CD-1799	LANDFILL CREST PAD BUILDING MCC	LANDFILL CREST PAD BUILDING UNIT HEATER	SURFACE MOUNT	3/4"	RGS	3#10, 1#10G	THWN	480V ac	E-202	
C014	AC-CD-251	LANDFILL CREST PAD BUILDING MCC	LANDFILL CREST PAD BUILDING AIR CONDITIONER	SURFACE MOUNT	3/4"	RGS	4#12, 1#12G	THWN	208V ac	E-202	
C015	D-CD-750	LANDFILL CREST PAD BUILDING MCC	LANDFILL CREST PAD BUILDING AIR CONDITIONER DAMPER MOTOR	SURFACE MOUNT	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C016	CP-CD-950	LANDFILL CREST PAD BUILDING MCC	LANDFILL CREST PAD BUILDING CONTROL PANEL	SURFACE MOUNT	1 1/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	
C017	CP-CD-950	LANDFILL CREST PAD BUILDING LIGHTING PANEL	LANDFILL CREST PAD BUILDING CONTROL PANEL	SURFACE MOUNT	3/4"	RGS	2#10, 1#10G	THWN	120V ac	E-202	
C018	ECS-CD-1799	LANDFILL CREST PAD BUILDING LIGHTING PANEL	LANDFILL CREST PAD BUILDING VOICE PAGER	BELOW GRADE	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C019	FP-CP-1	LANDFILL CREST PAD BUILDING LIGHTING PANEL	LANDFILL CREST PAD BUILDING FIRE PANEL	BELOW GRADE	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C020		LANDFILL CREST PAD BUILDING LIGHTING PANEL	LANDFILL CREST PAD BUILDING INTERIOR LIGHTING	SURFACE MOUNT	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C021		LANDFILL CREST PAD BUILDING LIGHTING PANEL	LANDFILL CREST PAD BUILDING EXTERIOR LIGHTING	SURFACE MOUNT	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C022		LANDFILL CREST PAD BUILDING LIGHTING PANEL	LANDFILL CREST PAD BUILDING RECEPTACLES	BELOW GRADE	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C023		LANDFILL CREST PAD BUILDING LIGHTING PANEL	LANDFILL CREST PAD BUILDING RECEPTACLES	BELOW GRADE	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C024	P-CD-206	LANDFILL CREST PAD BUILDING MCC	LANDFILL CREST PAD BUILDING SUMP PUMP	BELOW GRADE	3/4"	RGS	3#12, 1#12G	THWN	480V ac	E-202	
C025	LCP-CD-941	LANDFILL CREST PAD BUILDING SUMP PANEL	LANDFILL CREST PAD BUILDING MCC	BELOW GRADE	3/4"	RGS	8#14, 1#14G	THWN	24V dc	E-202	
C026	LCP-CD-941	LANDFILL CREST PAD BUILDING SUMP PANEL	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	8#14, 1#14G	THWN	24V dc	E-202	
C027	FE-CD-203-1	LANDFILL LCRS HIGH FLOW PUMP PROPELLER ELEMENT	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS		PVC/TSP	24V dc	E-202	Manufacturer cable
C028	FE-CD-203-2	LANDFILL LCRS LOW FLOW PUMP PROPELLER ELEMENT	LANDFILL LCRS HIGH FLOW PUMP PROPELLER TRANSMITTER	SURFACE MOUNT	3/4"	RGS	MFC	PVC/TSP	24V dc	E-202	Manufacturer cable
C029	FE-CD-204	LANDFILL LCRS PUMP FLOW PROPELLER ELEMENT	LANDFILL LCRS LOW FLOW PUMP PROPELLER TRANSMITTER	SURFACE MOUNT	3/4"	RGS	MFC	PVC/TSP	24V dc	E-202	Manufacturer cable
C030	FE-CD-208	LANDFILL LCRS PUMP FLOW PROPELLER ELEMENT	LANDFILL LCRS PUMP FLOW PROPELLER TRANSMITTER	SURFACE MOUNT	3/4"	RGS	MFC	PVC/TSP	24V dc	E-202	Manufacturer cable
C031	FT-CD-203-1	LANDFILL LCRS HIGH FLOW PUMP PROPELLER TRANSMITTER	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSP	24V dc	E-202	Combine cables
C032	FT-CD-203-2	LANDFILL LCRS LOW FLOW PUMP PROPELLER TRANSMITTER	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSP	24V dc	E-202	
C033	FT-CD-204	LANDFILL LCRS PUMP FLOW PROPELLER TRANSMITTER	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSP	24V dc	E-202	
C034	FT-CD-208	LANDFILL LCRS PUMP FLOW PROPELLER TRANSMITTER	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSP	24V dc	E-202	
C035	FT-CD-203-1	LANDFILL LCRS HIGH FLOW PUMP PROPELLER TRANSMITTER	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	Combine cables
C036	FT-CD-203-2	LANDFILL LCRS LOW FLOW PUMP PROPELLER TRANSMITTER	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	
C037	FT-CD-204	LANDFILL LCRS PUMP FLOW PROPELLER TRANSMITTER	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	
C038	FT-CD-208	LANDFILL LCRS PUMP FLOW PROPELLER TRANSMITTER	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	
C039	P-CD-203-1/LT-CD-103-1	LANDFILL LCRS SUBMERSIBLE PUMP AND PRESSURE TRANSDUCER	LANDFILL LCRS SUBMERSIBLE PUMP DISCONNECT AND TJB	BELOW GRADE	-	-	MFC	PVC/TSP	480V/24V dc	E-202	Manufacturer cable
C040	P-CD-203-2	LANDFILL LCRS SUBMERSIBLE PUMP	LANDFILL LCRS SUBMERSIBLE PUMP DISCONNECT	BELOW GRADE	-	-	MFC	PVC/TSP	480V	E-202	Manufacturer cable
C041	P-CD-204/LT-CD-104	LANDFILL LCRS SUBMERSIBLE LOW FLOW PUMP	LANDFILL LCRS SUBMERSIBLE PUMP DISCONNECT AND TJB	BELOW GRADE	-	-	MFC	PVC/TSP	480V/24V dc	E-202	Manufacturer cable
C042	LT-CD-103	LANDFILL LCRS SUBMERSIBLE PRESSURE TRANSDUCER TJB	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSP	24V dc	E-202	Combine cables
C043	LT-CD-104	LANDFILL LCRS SUBMERSIBLE PRESSURE TRANSDUCER TJB	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSP	24V dc	E-202	
C044	LT-CD-108	LANDFILL LCRS SUBMERSIBLE PRESSURE TRANSDUCER TJB	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSP	24V dc	E-202	
C045	TT-CD-1799	LANDFILL CREST PAD BUILDING TEMPERATURE TRANSMITTER	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSP	24V dc	E-202	
C046	P-CD-208/LT-CD-108	LANDFILL SLDRS SUBMERSIBLE PUMP AND PRESSURE TRANSDUCER	LANDFILL SLDRS SUBMERSIBLE PUMP DISCONNECT AND TJB	BELOW GRADE	-	-	MFC	PVC/TSP	480V/24V dc	E-202	Manufacturer cable
C047	FP-CP-1	LANDFILL CREST PAD BUILDING FIRE ALARM PANEL	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	PVC/TSP	24V dc	E-202	
C048	ZS-CD-1799	LANDFILL CREST PAD BUILDING DOOR INTRUSION SWITCH	LANDFILL CREST PAD BUILDING CONTROL PANEL	SURFACE MOUNT	3/4"	RGS	2#14, 1#14G	PVC/TSP	24V dc	E-202	
C049	YA-CD-1799-1	LANDFILL CREST PAD BUILDING GENERAL ALARM LIGHT	LANDFILL CREST PAD BUILDING CONTROL PANEL	SURFACE MOUNT	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	
C050	ECS-CD-1799	LANDFILL CREST PAD BUILDING VOICE PAGER	LANDFILL CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	4#14, 1#14G	PVC/TSP	24V dc	E-202	
C051	DSW-CD-201	EVAPORATION POND(S) CREST PAD BUILDING MCC	EVAPORATION POND(S) LCRS PUMP DISCONNECT	BELOW GRADE	3/4"	RGS	3#12, 1#12G	THWN	480V ac	E-202	
C052	UH-CD-1798	EVAPORATION POND(S) CREST PAD BUILDING MCC	EVAPORATION POND(S) CREST PAD BUILDING MCC	SURFACE MOUNT	3/4"	RGS	3#12, 1#12G	THWN	480V ac	E-202	
C053	P-CD-207	EVAPORATION POND(S) CREST PAD BUILDING MCC	EVAPORATION POND(S) COMBINED SUMP PUMP	BELOW GROUND	3/4"	RGS	3#12, 1#12G	THWN	480V ac	E-201	Provide conduit seals.
C054	CP-CD-951	EVAPORATION POND(S) CREST PAD BUILDING MCC	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	SURFACE MOUNT	1 1/4"	RGS	1#14, 1#14G	THWN	120V ac	E-202	
C055	AC-CD-250	EVAPORATION POND(S) CREST PAD BUILDING MCC	EVAPORATION POND(S) CREST PAD BUILDING AIR CONDITIONER	SURFACE MOUNT	3/4"	RGS	4#12, 1#12G	THWN	208V ac	E-202	
C056	D-CD-751	EVAPORATION POND(S) CREST PAD BUILDING MCC	EVAPORATION POND(S) CREST PAD BUILDING AIR CONDITIONER DAMPER MOTOR	SURFACE MOUNT	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	

CONDUIT AND CABLE SCHEDULE

CONDUIT	EQUIPMENT	FROM	TO	VIA	CONDUIT	CONDUIT	CABLE	CABLE	VOLTAGE	DRAWING	REMARKS
ID	NAME			SURFACE MOUNT	SIZE	TYPE	FILL	TYPE		NUMBER	
C057	CP-CD-951	EVAPORATION POND(S) CREST PAD BUILDING LIGHTING PANEL	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#10, 1#10G	THWN	120V ac	E-202	
C058	ECS-CD-1798	EVAPORATION POND(S) CREST PAD BUILDING LIGHTING PANEL	EVAPORATION POND(S) CREST PAD BUILDING VOICE PAGER	BELOW GRADE	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C059	FP-CP-2	EVAPORATION POND(S) CREST PAD BUILDING LIGHTING PANEL	EVAPORATION POND(S) CREST PAD BUILDING FIRE PANEL	BELOW GRADE	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C060		EVAPORATION POND(S) CREST PAD BUILDING LIGHTING PANEL	EVAPORATION POND(S) CREST PAD BUILDING INTERIOR LIGHTING	SURFACE MOUNT	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C061		EVAPORATION POND(S) CREST PAD BUILDING LIGHTING PANEL	EVAPORATION POND(S) CREST PAD BUILDING EXTERIOR LIGHTING	SURFACE MOUNT	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C062		EVAPORATION POND(S) CREST PAD BUILDING LIGHTING PANEL	EVAPORATION POND(S) CREST PAD BUILDING RECEPTACLES	BELOW GRADE	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C063		EVAPORATION POND(S) CREST PAD BUILDING LIGHTING PANEL	EVAPORATION POND(S) CREST PAD BUILDING RECEPTACLES	BELOW GRADE	3/4"	RGS	2#12, 1#12G	THWN	120V ac	E-202	
C064	LCP-CD-942	EVAPORATION POND(S) CREST PAD BUILDING SUMP PANEL	EVAPORATION POND(S) CREST PAD BUILDING MCC	BELOW GRADE	3/4"	RGS	8#14, 1#14G	THWN	24V dc	E-202	
C065	LCP-CD-942	EVAPORATION POND(S) CREST PAD BUILDING SUMP PANEL	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	8#14, 1#14G	THWN	24V dc	E-202	
C066	LCP-CD-943	EVAPORATION POND(S) COMBINED SUMP INTRINSIC SAFETY PANEL	EVAPORATION POND(S) CREST PAD BUILDING MCC	BELOW GRADE	3/4"	RGS	4#14, 1#14G	THWN	24V dc	E-202	
C067	LCP-CD-943	EVAPORATION POND(S) COMBINED SUMP INTRINSIC SAFETY PANEL	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	8#14, 1#14G	THWN	24V dc	E-202	
C068	LT-CD-101	EVAPORATION WEST POND(S) LDRS LEVEL TRANSDUCER	EVAPORATION WEST POND(S) LDRS LEVEL TRANSDUCER TJB	BELOW GRADE	-	-	MFC	PVC/TSPP	24V dc	E-202	Manufacturer cable
C069	LT-CD-102	EVAPORATION EAST POND(S) LDRS LEVEL TRANSDUCER	EVAPORATION EAST POND(S) LDRS LEVEL TRANSDUCER TJB	BELOW GRADE	-	-	MFC	PVC/TSPP	24V dc	E-202	Manufacturer cable
C070	LT-CD-101	EVAPORATION EAST POND(S) LDRS LEVEL TRANSDUCER TJB	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSPP	24V dc	E-202	Combine cables
C071	LT-CD-102	EVAPORATION WEST POND(S) LDRS LEVEL TRANSDUCER TJB	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSPP	24V dc	E-202	
C072	FE-CD-207	EVAPORATION POND(S) COMBINED SUMP FLOW PROPELLER ELEMENT	EVAPORATION POND(S) COMBINED SUMP FLOW PROPELLER TRANSMITTER	BELOW GRADE	3/4"	RGS	MFC	PVC/TSPP	24V dc	E-202	Manufacturer cable
C073	FE-CD-327	EVAPORATION POND(S) TRUCK LOADING/UNLOADING FLOW PROPELLER ELEMENT	EVAPORATION POND(S) TRUCK LOADING/UNLOADING FLOW PROPELLER TRANSMITTER	BELOW GRADE	3/4"	RGS	MFC	PVC/TSPP	24V dc	E-202	Manufacturer cable
C074	FE-CD-330	EVAPORATION POND(S) WASTEWATER FROM SSSTF FLOW PROPELLER ELEMENT	EVAPORATION POND(S) WASTEWATER FROM SSSTF FLOW PROPELLER TRANSMITTER	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSPP	24V dc	E-202	Combine cables
C075	FT-CD-207	EVAPORATION POND(S) COMBINED SUMP FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSPP	24V dc	E-202	
C076	FT-CD-327	EVAPORATION POND(S) TRUCK LOADING/UNLOADING FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSPP	24V dc	E-202	Combine cables
C077	FT-CD-330	EVAPORATION POND(S) WASTEWATER FROM SSSTF FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	
C078	FT-CD-207	EVAPORATION POND(S) COMBINED SUMP FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	Combine cables
C079	FT-CD-327	EVAPORATION POND(S) TRUCK LOADING/UNLOADING FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	
C080	FT-CD-330	EVAPORATION POND(S) WASTEWATER FROM SSSTF FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSPP	24V dc	E-202	Manufacturer cable
C081	TT-CD-1798	EVAPORATION POND(S) CREST PAD BUILDING TEMPERATURE TRANSMITTER	EVAPORATION POND(S) LDRS PUMP DISCONNECT	BELOW GRADE	-	-	MFC	PVC/TSPP	480V	E-202	
C082	P-CD-201	EVAPORATION POND(S) LDRS SUBMERSIBLE PUMP	EVAPORATION POND(S) LDRS PUMP DISCONNECT	BELOW GRADE	-	-	MFC	PVC/TSPP	480V	E-202	Manufacturer cable
C083	P-CD-202	EVAPORATION POND(S) LDRS SUBMERSIBLE PUMP	EVAPORATION POND(S) LDRS PUMP DISCONNECT	BELOW GRADE	-	-	MFC	PVC/TSPP	480V	E-202	Manufacturer cable
C084	LSH-CD-489	LANDFILL LEACHATE TRANSMISSION LINE LEAK DETECTION LEVEL FLOAT	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	24V dc	E-201	Manufacturer cable. Provide conduit seals.
C085	ZS-CD-1798	EVAPORATION POND(S) CREST PAD BUILDING DOOR INTRUSION SWITCH	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	SURFACE MOUNT	3/4"	RGS	2#14, 1#14G	THWN	24V dc	E-202	
C086	LSHH/L-CD-107	EVAPORATION POND(S) COMBINED SUMP LEVEL FLOATS	EVAPORATION POND(S) COMBINED SUMP INTRINSIC SAFETY PANEL	BELOW GRADE	1 1/4"	RGS	MFC		24V dc	E-201	Manufacturer cable
C087	FP-CP-2	EVAPORATION POND(S) CREST PAD BUILDING FIRE ALARM PANEL	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	4#14, 1#14G	THWN	24V dc	E-202	
C088	LSH-CD-109	SSSTF LINE VARV HIGH LEVEL FLOAT	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	24V dc	E-201	Manufacturer cable
C089	YA-CD-1798-1	EVAPORATION POND(S) CREST PAD BUILDING GENERAL ALARM LIGHT	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	SURFACE MOUNT	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	
C090	ECS-CD-1798	EVAPORATION POND(S) CREST PAD BUILDING VOICE PAGER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	SURFACE MOUNT	3/4"	RGS	4#14, 1#14G	THWN	24V dc	E-202	Combine cables
C091		EVAPORATION POND(S) CREST PAD BUILDING GENERATOR RECEPTACLE	EVAPORATION POND(S) CREST PAD BUILDING MCC	BELOW GRADE	1"	RGS	3#4, 1#8G	THWN	480V ac	E-202	
C092	DSW-CD-202	EVAPORATION POND(S) CREST PAD BUILDING MCC	EVAPORATION POND(S) LDRS PUMP DISCONNECT	BELOW GRADE	3/4"	RGS	3#12, 1#12G	THWN	480V ac	E-202	Combine cables
C093		LANDFILL CREST PAD BUILDING MCC	LANDFILL CREST PAD BUILDING MCC	BELOW GRADE	1"	RGS	3#4, 1#8G	THWN	480V ac	E-202	
C094	DSW-CD-209	EVAPORATION POND(S) CREST PAD BUILDING MCC	EVAPORATION POND(S) TRANSFER PUMP DISCONNECT	BELOW GRADE	3/4"	RGS	3#12, 1#12G	THWN	480V ac	E-202	Manufacturer cable
C095	FE-CD-210	RAW WATER FLOW PROPELLER ELEMENT	RAW WATER COMBINED SUMP FLOW PROPELLER TRANSMITTER	BELOW GRADE	3/4"	RGS	MFC	PVC/TSPP	24V dc	E-202	
C096	FE-CD-201	EVAPORATION POND(S) LEAK DETECTION FLOW PROPELLER ELEMENT	EVAPORATION POND(S) LEAK DETECTION FLOW PROPELLER TRANSMITTER	BELOW GRADE	3/4"	RGS	MFC	PVC/TSPP	24V dc	E-202	Manufacturer cable
C097	FE-CD-202	EVAPORATION POND(S) LEAK DETECTION FLOW PROPELLER ELEMENT	EVAPORATION POND(S) LEAK DETECTION FLOW PROPELLER TRANSMITTER	BELOW GRADE	3/4"	RGS	MFC	PVC/TSPP	24V dc	E-202	
C098	FT-CD-210	RAW WATER FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSPP	24V dc	E-202	Combine cables
C099	FT-CD-201	EVAPORATION POND(S) LEAK DETECTION FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSPP	24V dc	E-202	
C100	FT-CD-210	RAW WATER FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSPP	24V dc	E-202	Combine cables
C101	FT-CD-210	RAW WATER FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	
C102	FT-CD-201	EVAPORATION POND(S) LEAK DETECTION FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	Combine cables
C103	FT-CD-202	EVAPORATION POND(S) LEAK DETECTION FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	
C104	FE-CD-211	TRUCK LOADING FLOW PROPELLER ELEMENT	TRUCK LOADING FLOW PROPELLER TRANSMITTER	BELOW GRADE	3/4"	RGS	MFC	PVC/TSPP	24V dc	E-202	Manufacturer cable
C105	FT-CD-211	TRUCK LOADING FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	1-TYPE 3	PVC/TSPP	24V dc	E-202	
C106	FT-CD-211	TRUCK LOADING FLOW PROPELLER TRANSMITTER	EVAPORATION POND(S) CREST PAD BUILDING CONTROL PANEL	BELOW GRADE	3/4"	RGS	2#14, 1#14G	THWN	120V ac	E-202	

1 SECTION 16480--LOW VOLTAGE MOTOR CONTROL

2
3 PART 1--GENERAL

4
5 UL COMPLIANCE:

6
7 Products manufactured within scope of Underwriters Laboratories shall conform to UL
8 Standards and have an applied UL Listing Mark.
9

10 ELECTRICAL DESCRIPTION OF WORK:

11
12 Provide the following 480-volt, three-phase, three-wire with ground, 600-amp service rated
13 motor control centers in accordance with this Specification and Contract Drawings:
14

15 MCC-CD-2179 to be installed inside the INEEL CERCLA Evaporation Ponds Crest
16 Pad Building.
17

18 MCC-CD-2181 to be installed inside the INEEL CERCLA Landfill Crest Pad
19 Building.
20

21 MCC-CD-2179 center shall provided with the following minimum features in accordance
22 with this Specification and Contract Drawings:
23

24 Main Breaker.

25
26 Phase Loss and Reversal Protection Relay.

27
28 Generator Breaker.

29
30 Generator Interlock Key.

31
32 Volt and Current Meters.

33
34 Lighting Panel LP-CD-2180.

35
36 Lighting Panel Transformer XFR-CD-8553.

37
38 ECP Control Section (Feed from lighting panel)

39
40 NEMA 1 Size Motor Starters (four each).

41
42 NEMA Breakers.

43
44 Three Sections.
45

Project Title: ICDF Landfill and Evaporation Pond RD/CWP – Title II
Document Type: Technical Specifications
SPC Number: 1476
Revision Number: 2

MCC-CD-2181 center shall provided with the following minimum features in accordance with this Specification and Contract Drawings:

Main Breaker.

Phase Loss and Reversal Protection Relay.

Generator Breaker.

Generator Interlock Key.

Volt and Current Meters.

Lighting Panel LP-CD-2182.

Lighting Panel Transformer XFR-CD-8552.

ECP Control Section (Feed from lighting panel)

NEMA 1 Size Motor Starters (five each).

NEMA Breakers.

Three Sections.

PACKING AND SHIPPING:

Shipping Splits: Established by Construction Subcontractor to facilitate ingress of equipment to final installation location within the building.

PART 2--PRODUCTS

MANUFACTURERS:

Allen-Bradley.

Cutler-Hammer/Westinghouse.

Square D.

MOTOR CONTROL:

General:

Like Items of Equipment: End product and responsibility of one manufacturer.

Make adjustments as necessary to wiring, conduit, disconnect devices, motor starters, branch circuit protection, and other affected material or equipment to accommodate motors actually provided under this Contract.

Controllers: NEMA ICS 2, Class A.

Thermal Overload Protection:

Inverse-time-limit characteristic.

Heater: Class 10, bimetallic overload, adjustable trip.

Relay Trip: Standard, Class 20.

Manual reset.

Provide in each ungrounded phase.

Mount within starter unit.

Control Transformer:

Two winding, 120-volt secondary, primary voltage to suit.

Two current-limiting fuses for primary circuit.

One fuse in secondary circuit.

Mount within starter unit.

Suitable for use with 75 degrees C copper wire at full NFPA 70, 75 degrees C ampacity.

Lifting lugs on all equipment and devices weighing over 100 pounds.

Operating Conditions:

Ambient Temperature: Maximum 40 degrees C.

Equipment to be fully rated without any derating for operating conditions listed in Section 16005, ELECTRICAL.

Enclosures: In accordance with NEMA 250 and ANSI C57.12.28.

1 Equipment Finish:

2
3 Electrocoating process applied over a rust-inhibiting phosphated base coating.

4
5 Exterior Color: Manufacturer's standard.

6
7 Manually Operated Starter, Fractional Horsepower:

8
9 Rating: 16 amperes continuous at 277 volts maximum, or horsepower rated for the
10 voltage and horsepower of the load served.

11
12 Single-phase, nonreversing, full voltage with overload protection.

13
14 Toggle operated.

15
16 Enclosure: Reference Section 16005, ELECTRICAL, Article ENVIRONMENTAL
17 CONDITIONS.

18
19 Neon Light: Red.

20
21 Handle guard/lock-off attachment.

22
23 Combination Full-Voltage, Magnetic Starter:

24
25 Rating: Hp rated at 600 volts, UL labeled for 42,000 amperes fault current withstand
26 capacity with overload protection.

27
28 Three-phase, nonreversing, full voltage.

29
30 Control: HAND/OFF/AUTO selector switch.

31
32 Disconnect Type: Motor circuit protector.

33
34 Enclosure: Reference Section 16005, ELECTRICAL, Article ENVIRONMENTAL
35 CONDITIONS.

36
37 Pilot Lights: Red—ON and Green—OFF.

38
39 Padlockable operating handle.

MOTOR CONTROL CENTERS:

General:

Motor Control Center to be manufactured and provided as a complete UL-approved assembly that includes the following major components specified under this section and Section 16005, ELECTRICAL:

Motor starters.

Feeder and main breaker.

Power monitoring.

Lighting and power distribution panelboard.

Lighting and power distribution stepdown transformer.

In accordance with NEMA ICS 2 and UL 845.

Voltage Rating: 600 volts.

Short Circuit Rating: 42,000 minimum amperes rms symmetrical for entire motor control center as a complete assembly.

All controllers, main and branch circuit breakers, wire connections, and other devices to be front mounted and accessible unless otherwise noted.

NEMA ICS 2, Section 322.08.

Class: I.

Type: B.

Wire remote control and signal circuits to separate terminal board in each motor starter compartment.

Enclosure:

Type: NEMA 250 Type 12 unless otherwise rated.

Vertical Section Dimensions: 90 inches high, 20 inches wide, 20 inches deep.

1 Construction:

2
3 Sheet steel reinforced with channel or angle irons.

4
5 Butt sections flush, end-to-end against similar section without bolts, nuts, or
6 cover plates causing interference.

7
8 Removable top cover plates and bottom cover plates.

9
10 Section Mounting: Removable formed-steel channel sills and lifting angles to meet
11 specified seismic requirements.

12
13 Horizontal Wiring Compartments: Accessible from front, full width, top and bottom.

14
15 Vertical Wiring Compartment: Full height, isolated from unit starters with separate
16 door.

17
18 Unit Compartment: Individual compartments separated by steel barriers for each
19 starter, feeder, or other unit capable of being wired from front without unit removal.

20
21 Compartment Doors: Separate hinged doors for each starter, feeder, or other unit.

22
23 Door Interlocking: Interlock starter and feeder doors mechanically so doors cannot be
24 opened with unit energized. Provide defeater mechanism to allow intentional access
25 at any time.

26
27 External disconnect handles, padlockable in OFF position.

28
29 Cable Entrance: Incoming service enters from bottom; control and feeder circuits
30 enter from top and bottom.

31
32 Bus:

33
34 Horizontal Power Bus:

35
36 Three-phase tin-plated, fully insulated, copper, entire width of control center,
37 rated 600 amperes.

38
39 Construct to allow future extension of additional sections.

40
41 Pressure type solderless lugs for each incoming line cable.

42
43 Isolated from top horizontal wireway.

44
45 Provide Belleville washers on bus connection bolts.

Vertical Power Bus:

Three-phase tin-plated, fully insulated, copper, full height of section, rated 300 amperes.

Sandwich type bus insulation providing deadfront construction with starter units removed except for bus stab openings.

Insulated and isolated barrier complete with shutters.

Provide Belleville washers on bus connection bolts.

Ground Bus:

Copper, tin-plated, 33 percent minimum of phase bus ampacity, entire width of control center.

Provide Belleville washers on bus connection bolts.

Bus Bracing: 42,000 minimum amperes rms symmetrical.

Motor Controller Unit:

Provide indicated individual components and control devices including pushbuttons, selector switches, indicating lights, control relays, time delay relays, and elapsed time meters as specified in this section.

Construction:

Drawout combination type with stab connections for starters NEMA ICS, Size 4 and smaller.

Readily interchangeable with starters of similar size.

Pull-apart unit control wiring terminal boards on all units.

Starters:

NEMA ICS 2, Section 322.08 standard rating, except none smaller than NEMA ICS, Size 1.

Rating: Hp rated at 600 volts, UL labeled for 42,000 amperes fault current withstand capacity with overload protection.

Three-phase, nonreversing.

Disconnect Type: Motor circuit protector.

Combination Full Voltage, Magnetic Starter:

Control: ON/OFF/AUTO selector switch. As shown.

Pilot Lights: Red—ON; Green—OFF.

Padlockable operating handle when de-energized.

Unit door interlocked to prevent opening when disconnect is in closed position.

Mechanical interlocked to prevent placing disconnect in ON position when unit door is open.

Minimum Dimensions: 12 inches high by full section width, less vertical wireway.

Disconnecting Device:

In each starter, control circuit disconnect to de-energize circuits in unit which are not de-energized by starter power disconnect device.

Padlockable in OPEN position.

Circuit Breaker:

Meeting the requirements of NEMA AB1 and UL 489.

Molded case with manufacturer's recommended trip setting for maximum motor protection.

Thermal-magnetic trip or magnetic trip only as shown.

Tripping indicated by operating-handle position.

Interrupting capacity required for connection to system with short circuit capacity indicated.

1 Motor Overload Protection:
2

3 Temperature compensated, three-pole relay with bimetallic, adjustable trip
4 elements.

5
6 Manual-reset overload relays.
7

8 Motor Thermal Protector Interface: Manual-reset interposing relay for connection to
9 motor-mounted thermal protector system.
10

11 Control Unit:
12

13 Disconnecting Device: Capable of de-energizing external source control circuits in
14 unit.
15

16 Control Devices: As indicated and as specified in Section 16005, ELECTRICAL.
17

18 Control Wiring:
19

20 Minimum wire size 14 AWG copper.
21

22 Permanent sleeve type markers with wire numbers applied to each end of
23 wires.
24

25 Terminate current transformer leads on shorting type terminal blocks.
26

27 Feeder Unit and Main Protective Device:
28

29 Construction: As specified in paragraph Motor Controller Unit.
30

31 Incoming Service Feeder: Cable entering section at bottom.
32

33 Molded Case Circuit Breaker:
34

35 In accordance with NEMA AB1 and UL 489.
36

37 Main and Feeder protective device.
38

39 UL labeled as suitable for service entrance.
40

41 Thermal-magnetic trip and interrupting capacity required for connection to
42 system with short circuit capacity indicated.
43

44 Shunt trip on main breaker only.
45

1 Indicate tripping by operating-handle position.

2
3 Suitable for use with 75 degrees C copper wire at full NEC 75 degrees C
4 ampacity.

5
6 Phase Monitoring Relay: Three-phase monitoring relay to protect against phase loss
7 and phase reversal.

8
9 Time Delay Relay:

10
11 Industrial Relay Rated: 600 volts, 5 amps continuous, (3,600 VA make, 360 VA
12 break).

13
14 Solid-state electronic, field convertible ON/OFF delay.

15
16 One normally open and one normally closed contact (minimum).

17
18 Repeat accuracy plus or minus 2 percent.

19
20 Timer adjustment from 1 to 60 seconds, unless otherwise indicated on the Drawings.

21
22 Manufacturers and Products:

23
24 Allen-Bradley.

25
26 Square D Co.; Type F.

27
28 Cutler-Hammer.

29
30 Reset Timer:

31
32 Timing Method: Solid state with LCD display.

33
34 Mounting: Semi-flush, panel.

35
36 Contacts: 5-amp, 120-volt.

37
38 Manufacturers and Products:

39
40 Allen-Bradley; 700-HX.

41
42 Square D.

1 Elapsed Time Meter:

2
3 Drive: Synchronous motor.

4
5 Range: 0 to 99,999.9 hours, non-reset type.

6
7 Mounting: Semi-flush, panel, rectangular with screw terminals.

8
9 Manufacturers:

10
11 Veeder-Root.

12
13 Redington.

14
15 Magnetic Contactor:

16
17 UL listed.

18
19 Electrically operated, electrically held.

20
21 Main Contacts:

22
23 NEMA B600 contacts.

24
25 Electrically held.

26
27 Silver alloy with wiping action and arc quenchers.

28
29 NEMA Size 0 or 1 as required for the motor controller.

30
31 Three-pole.

32
33 Control: Two-wire.

34
35 One normally open and one normally closed auxiliary contact rated
36 10 amperes at 480 volts.

37
38 Manufacturers and Products:

39
40 Allen-Bradley.

41
42 Square D Co.; Type F.

43
44 Cutler-Hammer.

Pushbutton, Indicating Light and Selector Switches:

Contact Rating: NEMA ICS 2, Type A600.

Selector Switch Operating Lever: Standard.

Indicating Lights: Push-to-test, LED, full voltage.

Pushbutton Color:

ON or START: Black.

OFF or STOP: Red.

Pushbuttons and selector switches lockable in OFF position where indicated.

Legend Plate:

Material: Aluminum.

Engraving: 11 character/spaces on one line, 14 character/spaces on each of two lines, as required, indicating specific function.

Letter Height: 7/64 inch.

Manufacturers:

Allen-Bradley.

Square D Co.

Cutler-Hammer.

Nameplates:

Laminated plastic; white, engraved to black core.

Provide for each motor control center and each unit.

Engrave with inscription shown on single-line diagram.

Provide blank nameplates on spaces for future units.

Attach with stainless steel panhead screws on face of control center.

Factory Testing: NEMA ICS 1, Section 109, or UL 486A if not specified by the manufacturer.

PART 3--EXECUTION

INSTALLATION:

Install equipment in accordance with NEMA ICS 2.3, Submittal Drawings, and Manufacturer's Instructions and Recommendations.

Secure equipment to mounting pads with anchor bolts of sufficient size and number adequate for specified seismic conditions. Reference Section 13122, METAL BUILDING SYSTEMS, Part 2, Article DESIGN LOADS, for information on seismic loading. Install suitable braces from MCC to building structural members for seismic support.

Install equipment plumb and in longitudinal alignment with pad or wall.

Coordinate terminal connections with installation of secondary feeders.

Grout mounting channels into floor or mounting pads.

Retighten current-carrying bolted connections and enclosure support framing and panels to manufacturer's recommendations.

CIRCUIT BREAKERS (MAGNETIC-TRIP-ONLY):

Field adjust trip settings of motor starter magnetic-trip-only circuit breakers.

Adjust to approximately 11 times motor rated current in accordance with NEC 430-52.

Determine motor rated current from motor nameplate following installation.

OVERLOAD RELAY:

Select and install overload relay heaters after the actual nameplate full-load current rating of motor has been determined.

MOTOR DATA:

Provide typed, self-adhesive label attached outside each motor starter enclosure door displaying the following information with plastic black and white lettering, minimum 1/2-inch size:

Motor served by tag number and equipment name.

Project Title: ICDF Landfill and Evaporation Pond RD/CWP – Title II
Document Type: Technical Specifications
SPC Number: 1476
Revision Number: 2

- 1 Nameplate horsepower.
- 2
- 3 Motor code letter.
- 4
- 5 Full load amperes.
- 6
- 7 Service factor.
- 8
- 9 Installed overload relay heater catalog number.
- 10
- 11 END OF SECTION 16480